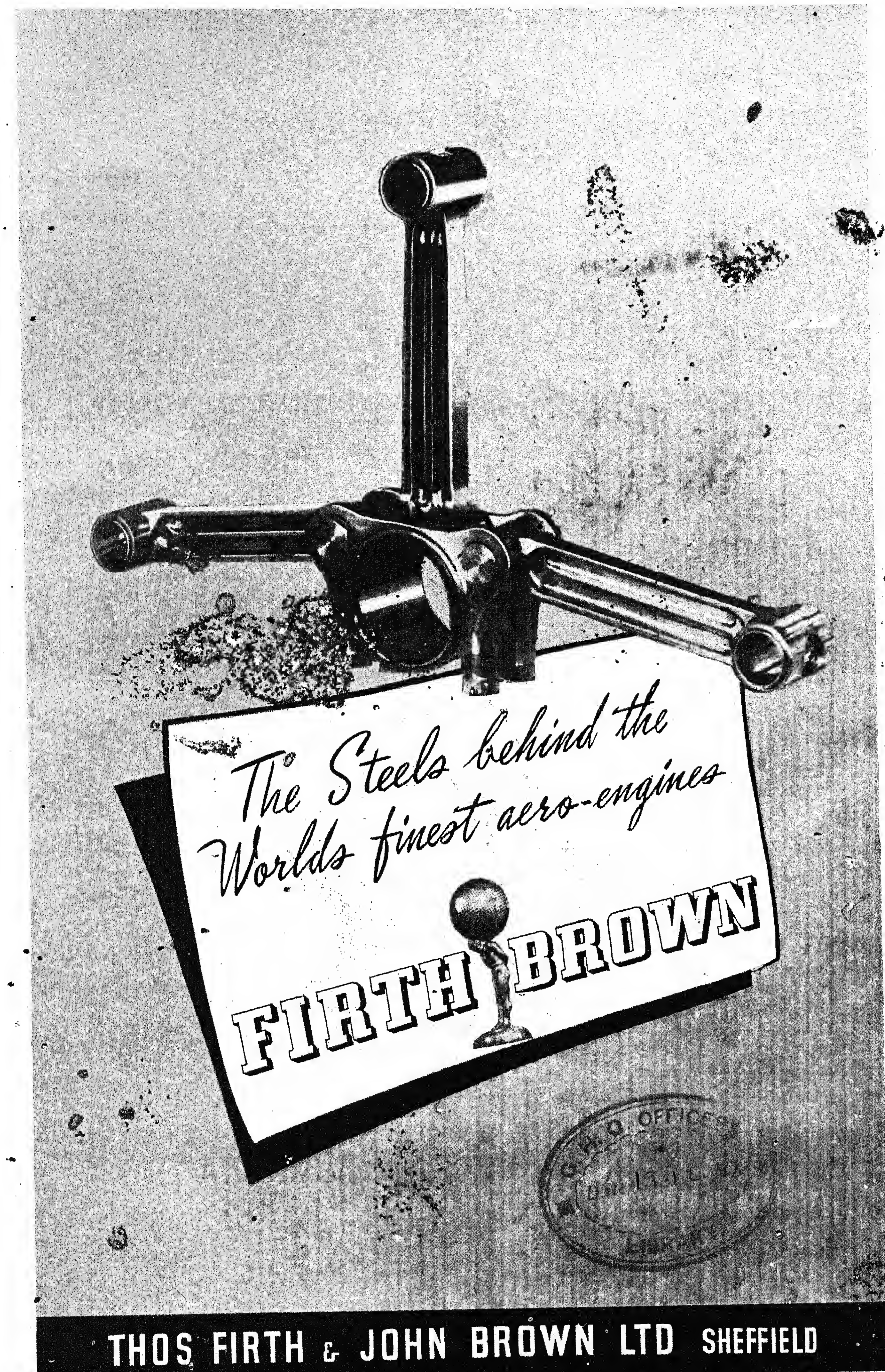
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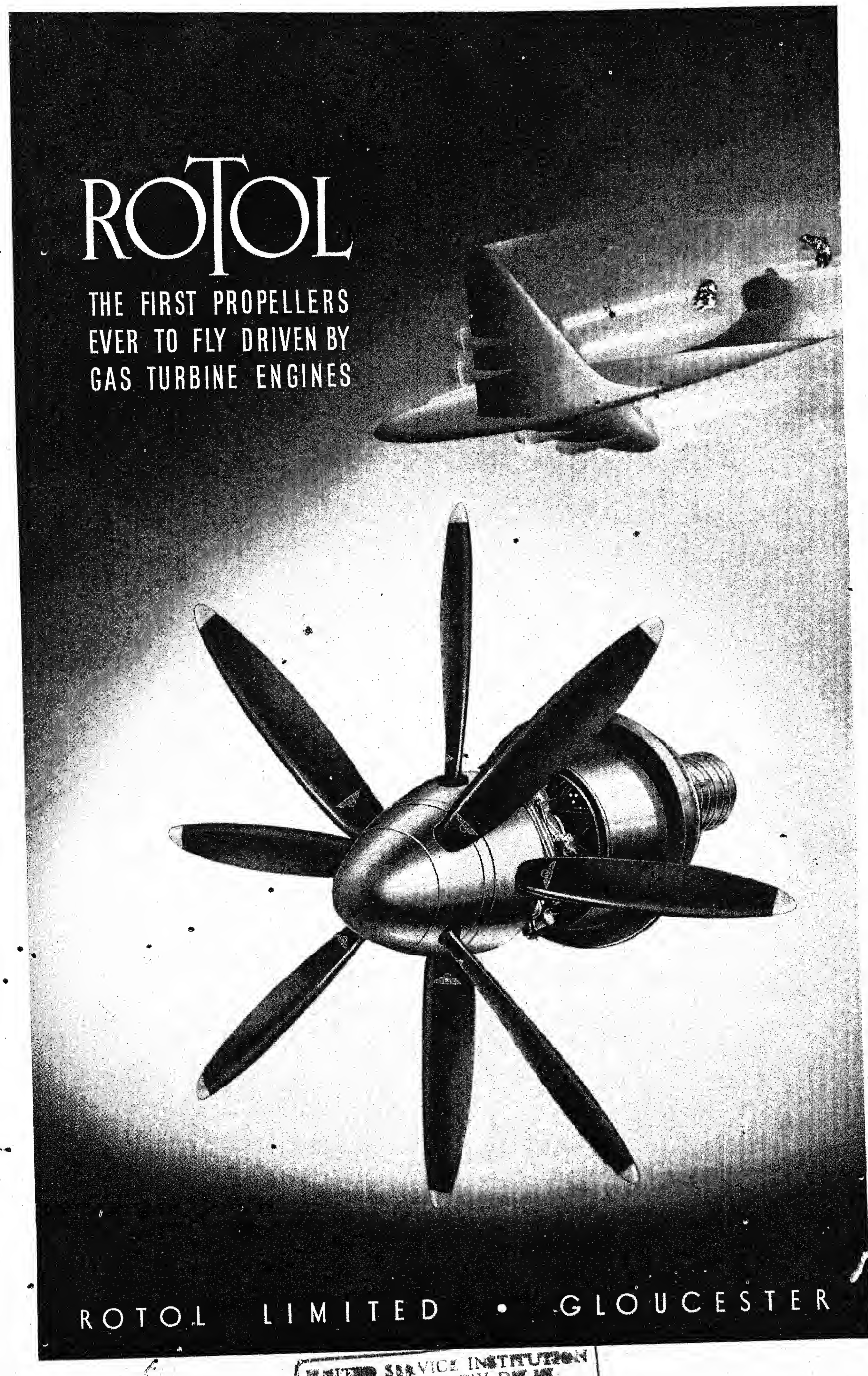
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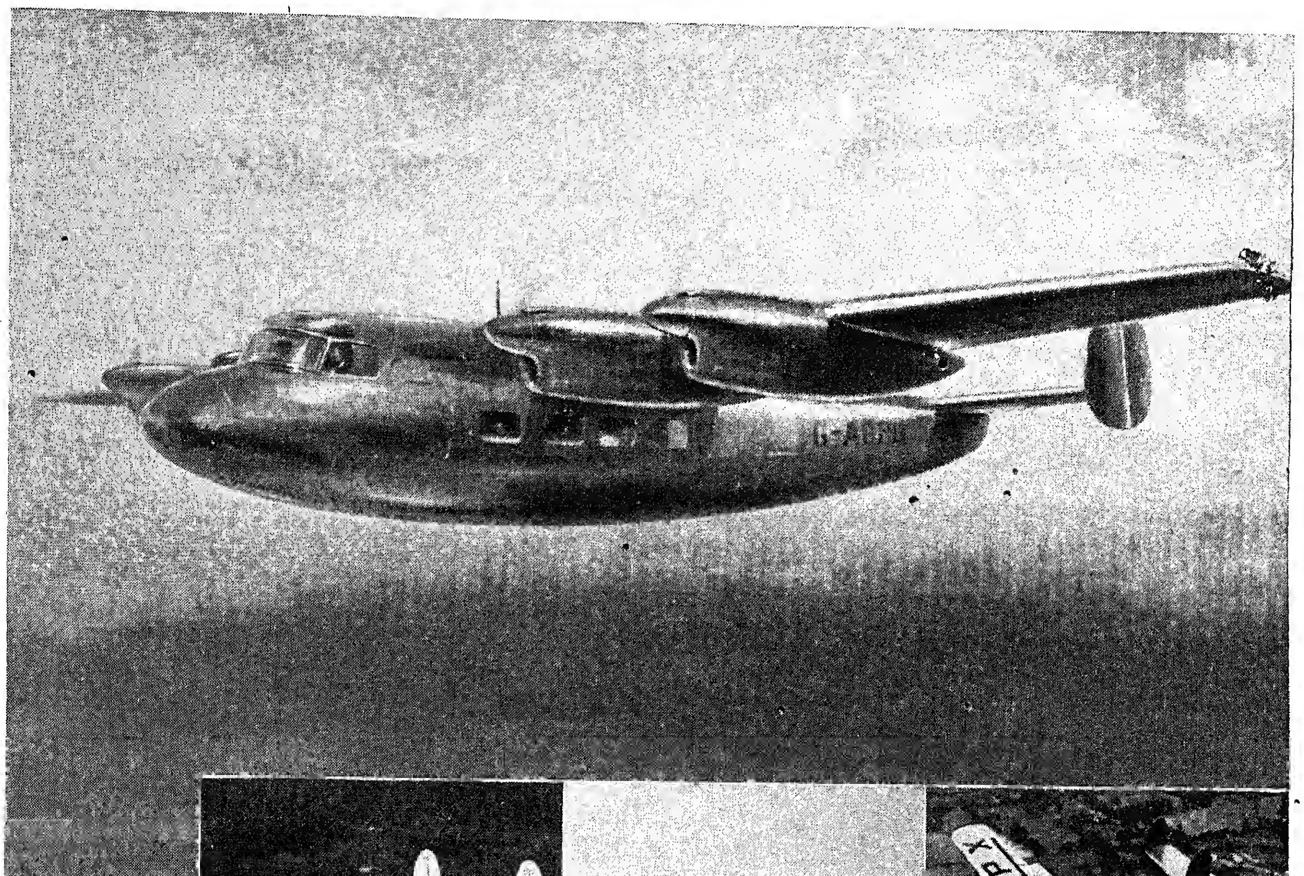

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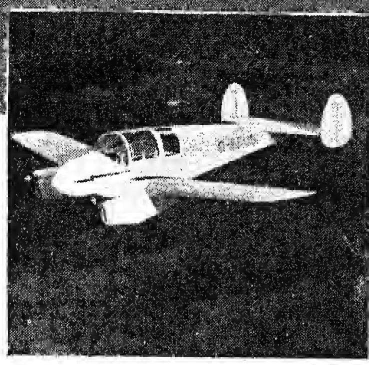

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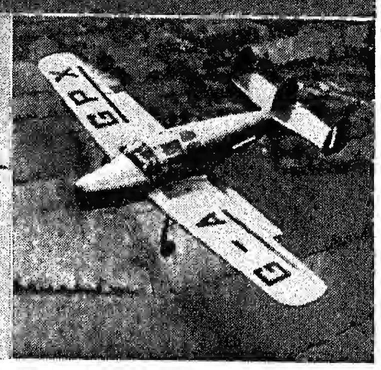

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During the years 1939-1945 Miles production was concentrated mainly upon two types—the MAGISTER, standard monoplane elementary trainer and the MASTER, the advanced trainer without which, to quote a leading aeronautical journal "the steady flow of pilots to our fighter squadrons could never have been maintained." Today the production programme features four aircraft, each designed to fill a particular need:—

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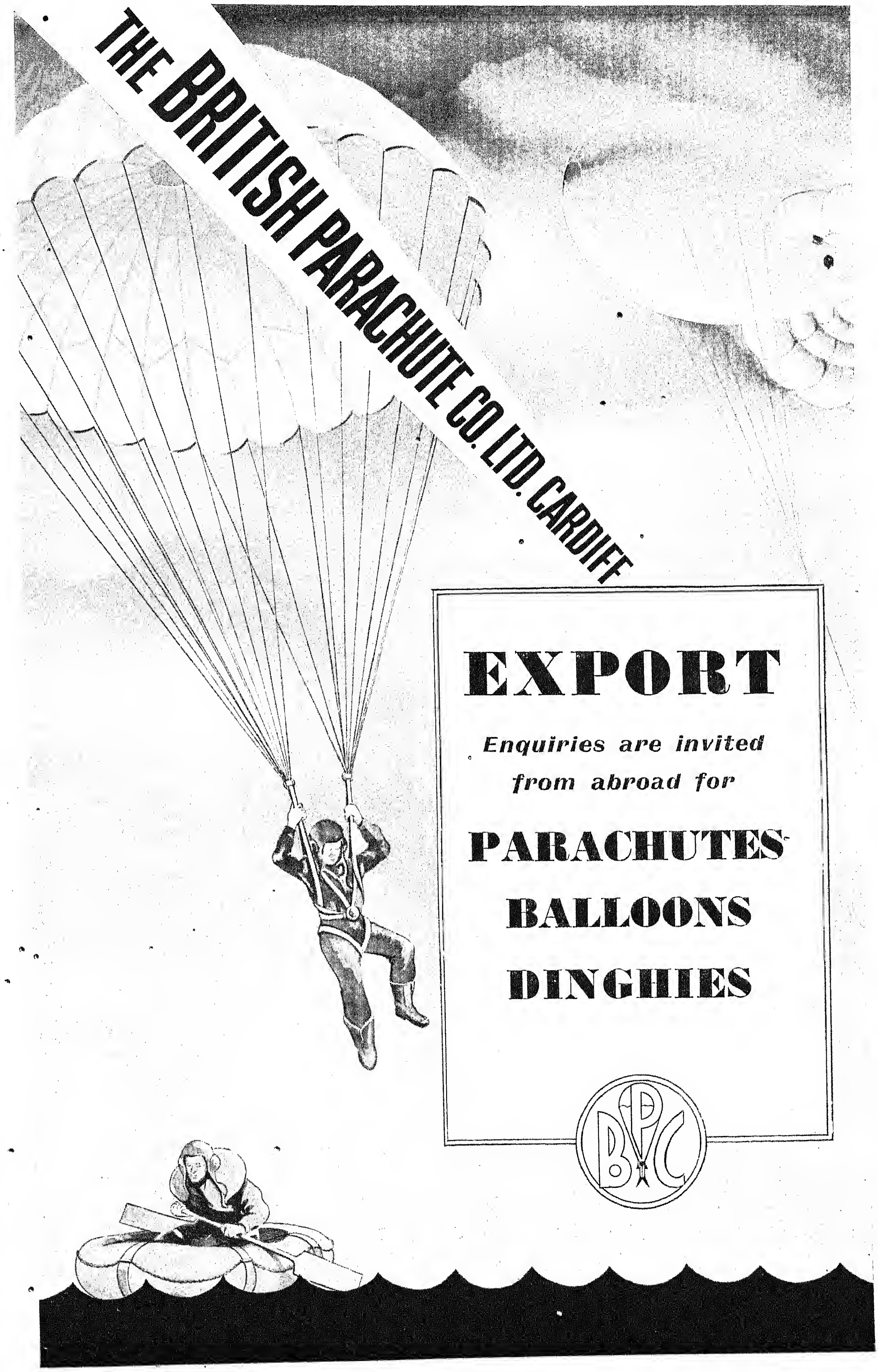
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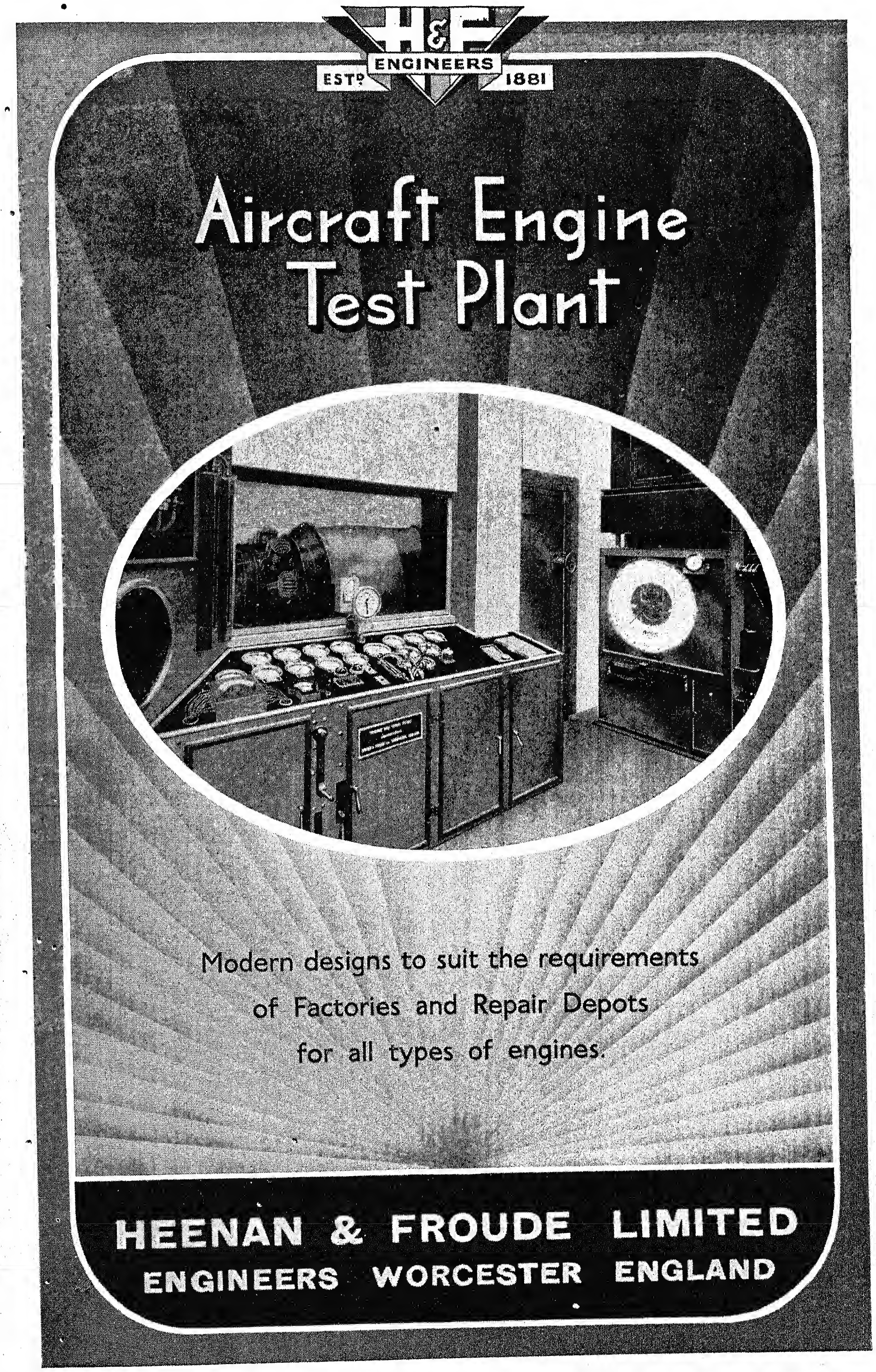
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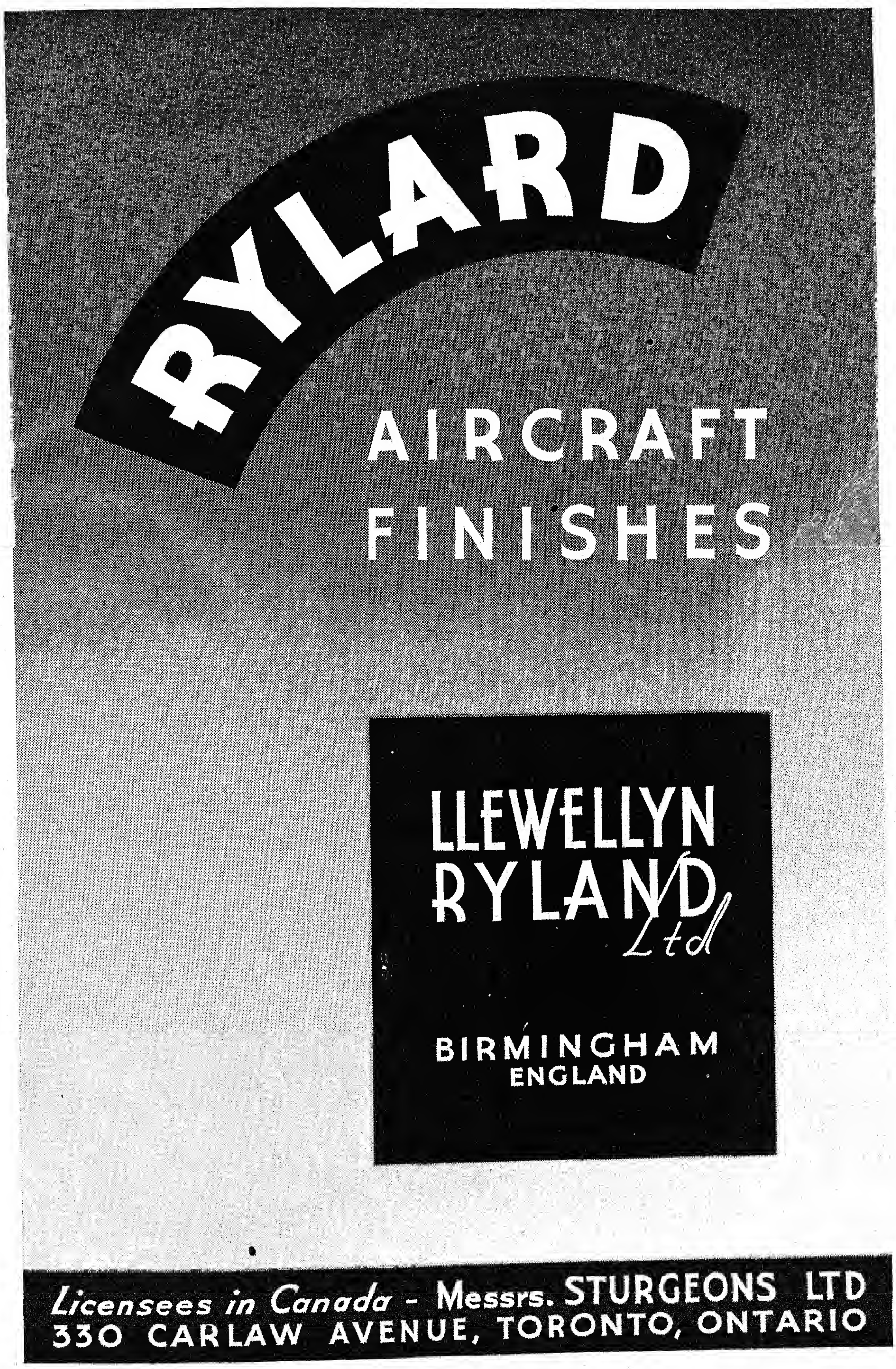
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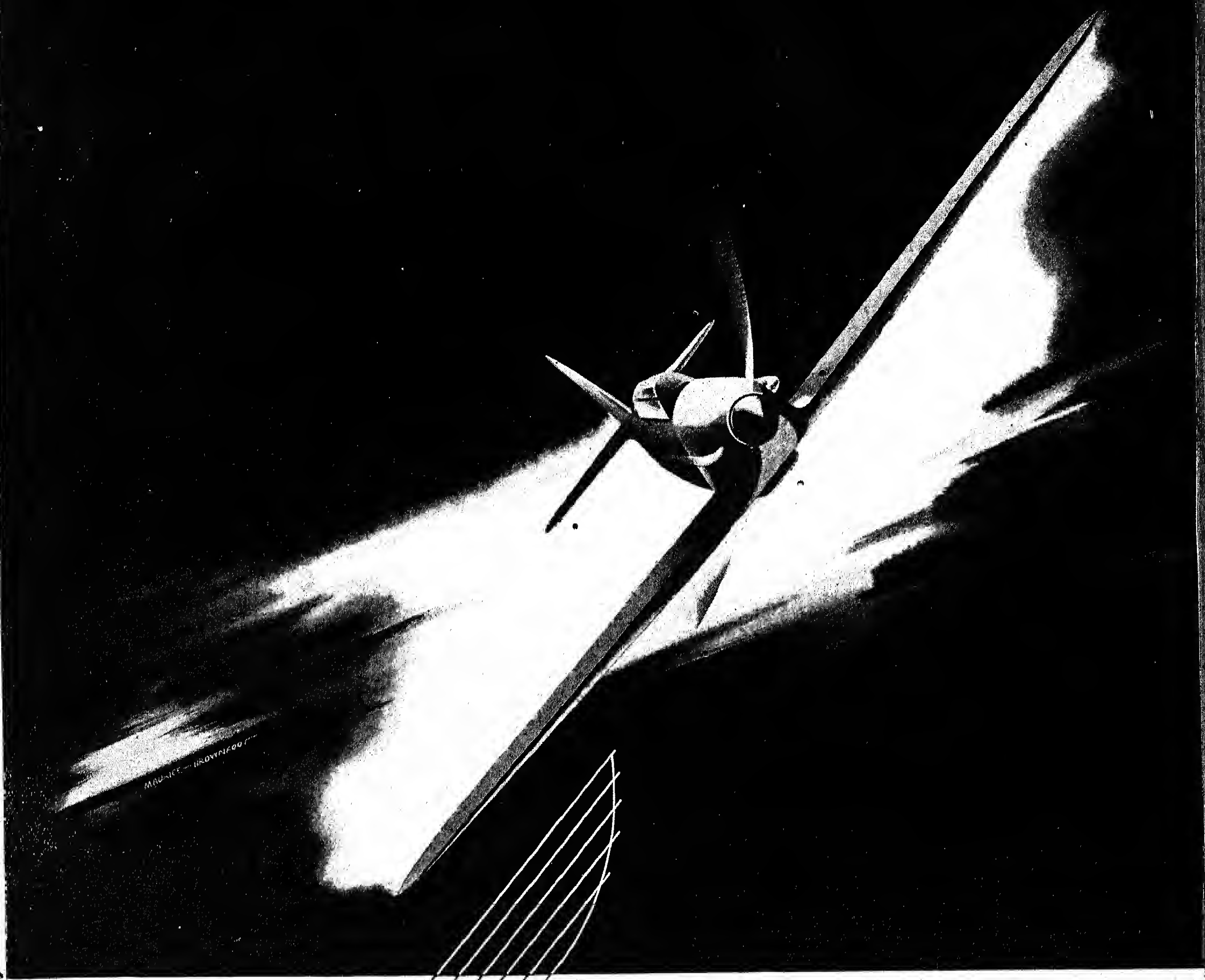

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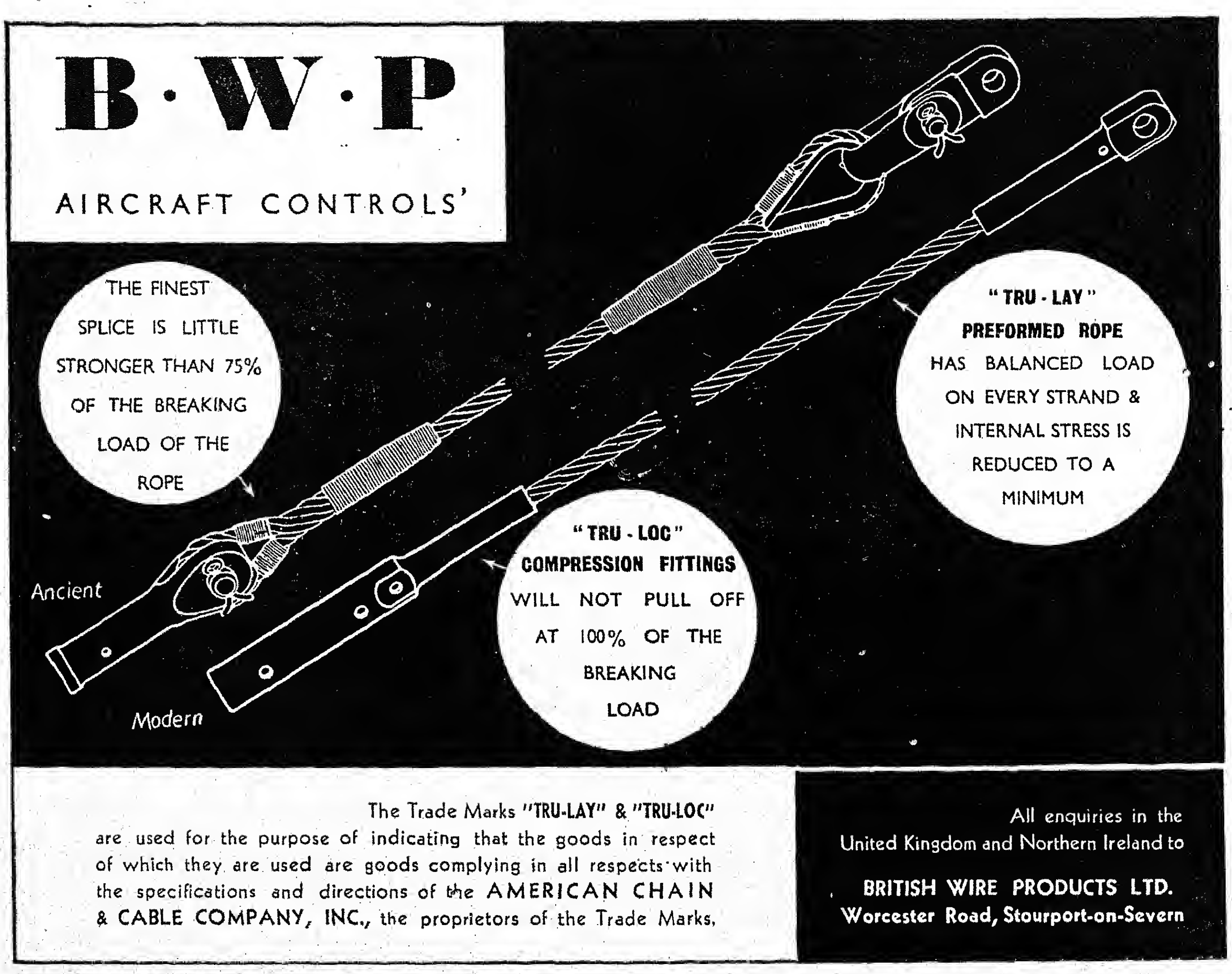
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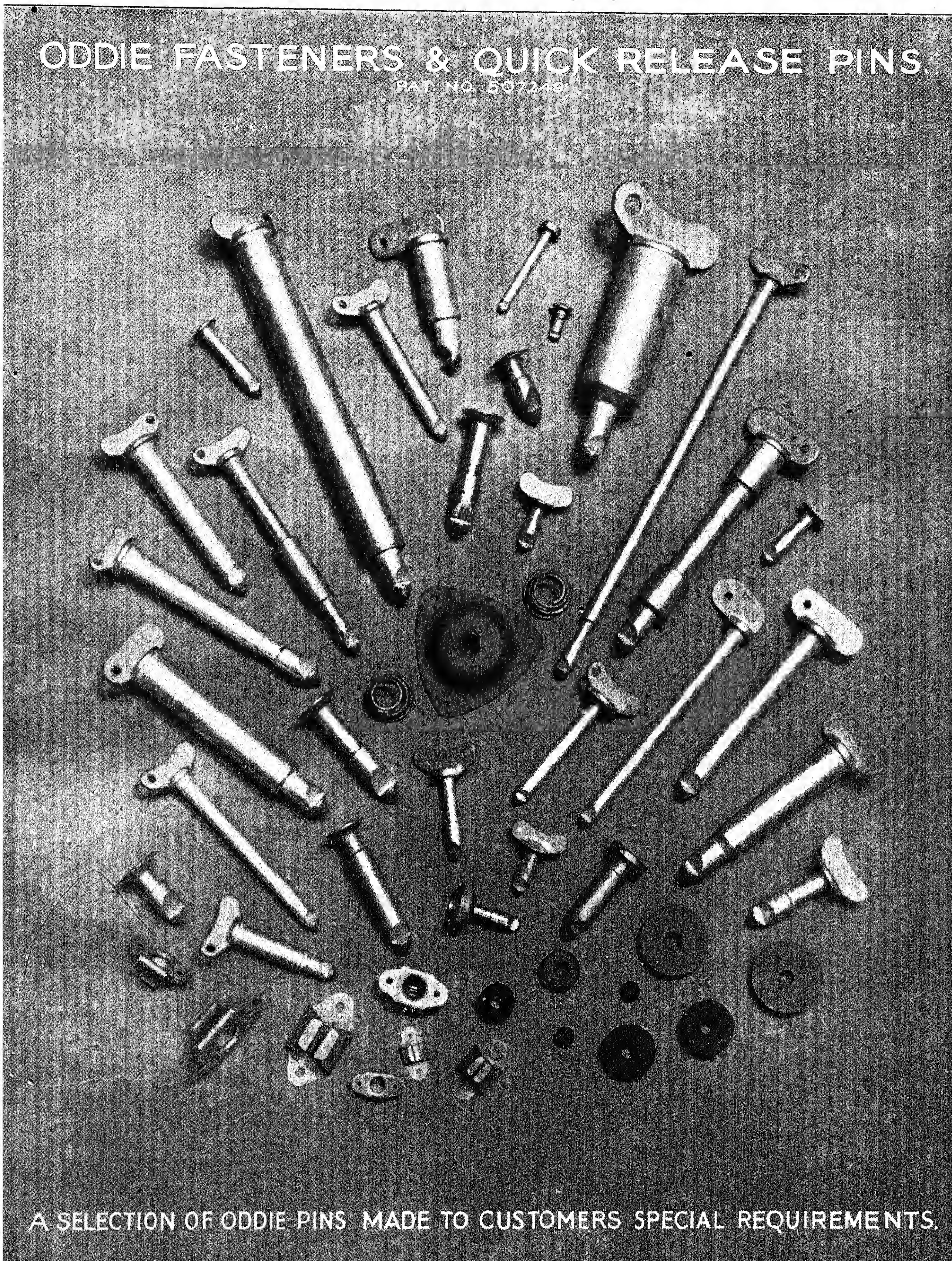

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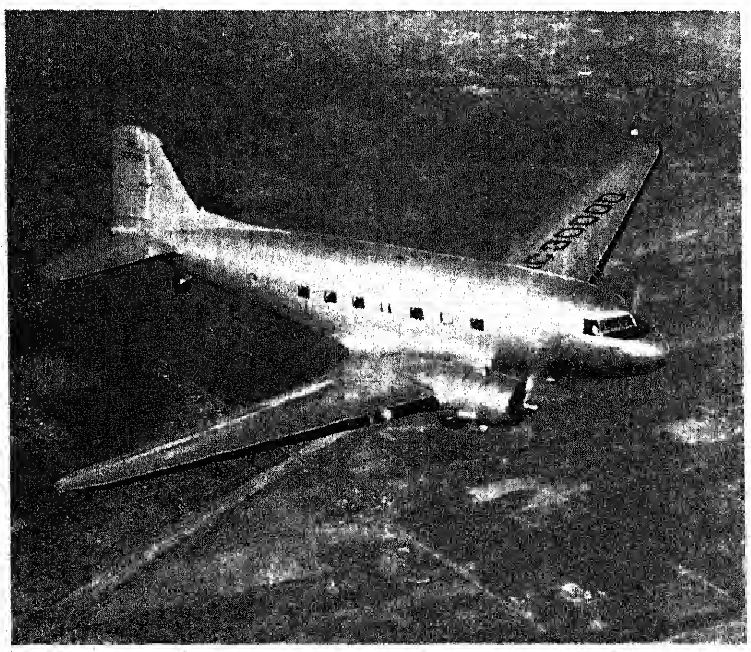

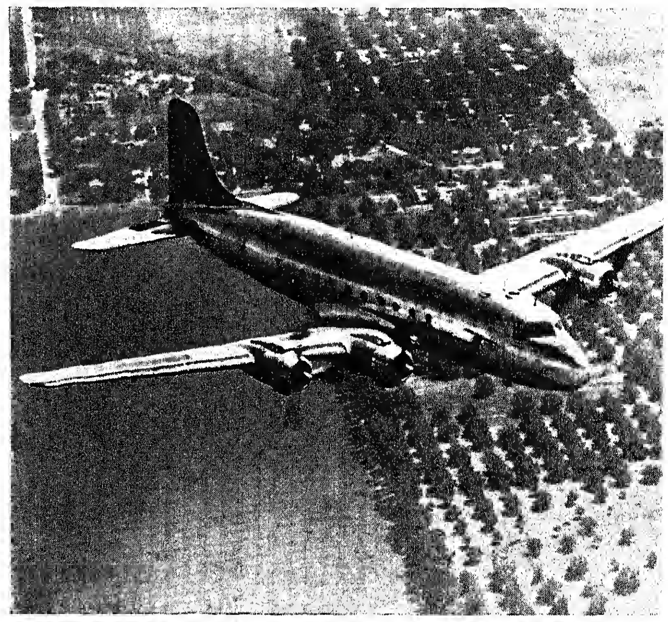

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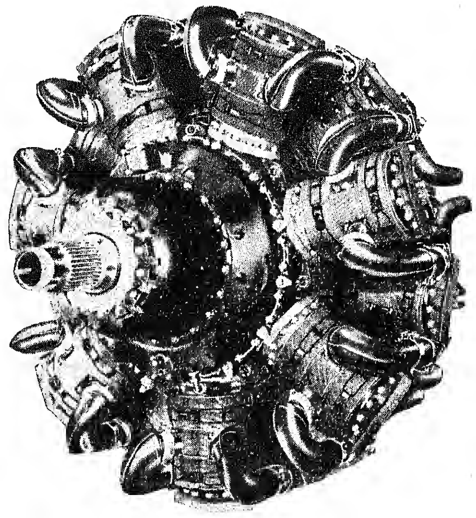
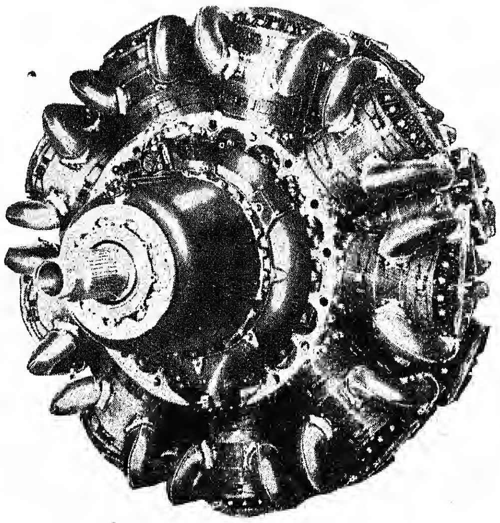
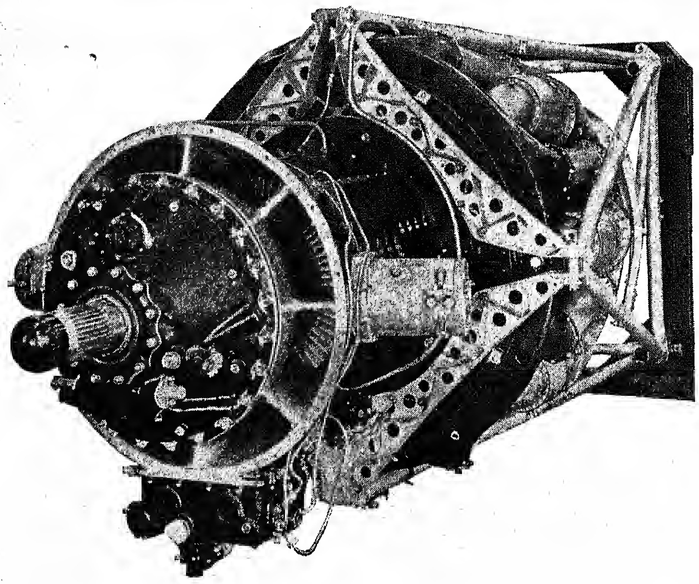


The latest "Bristol" Hercules and Centaurus engines are the result of twenty-seven years' concentration upon the development of the air-cooled radial type of reciprocating engine for aircraft, during which many major advances in design and manufacturing technique have been pioneered and firmly established by the "Bristol" Engine Division.



Hercules The famous war-proved 14-cylinder sleeve-valve radial. Available in several alternative versions to suit military and civil installations, with maximum powers up to 2,055 B.H.P.

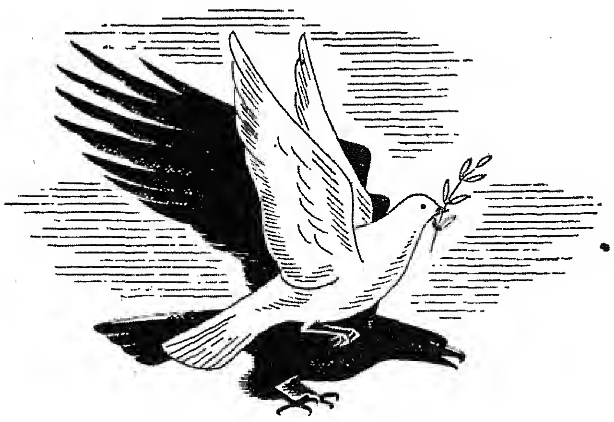
Centaurus The most powerful engine of its type in the world, developing up to 3,000 B.H.P. from 18 air-cooled cylinders, with all the well-proved sleeve-valve advantages of fuel economy, simplicity, minimum maintenance and compactness of installation.



Theseus Already an acknowledged leader in reciprocating aero-engines, this company is now able to reveal some of its achievements following long-term research and development in gas-turbines. It is with the THESEUS I—forerunner of a range of "Bristol" gas-turbine engines—that we introduce this aspect of the company's activities. Although the THESEUS engine was primarily designed as a development type, many aircraft constructors are showing great interest in its potentialities. It incorporates a heat exchanger and a separate propeller drive in addition to many other features, and it is notable for its high thermal efficiency and reliability—basic characteristics of all future "Bristol" gas-turbine engines.

"Bristol"

aero-engine development



The regard is mutual

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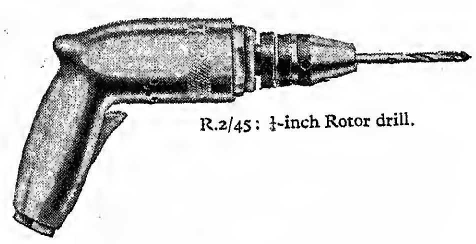
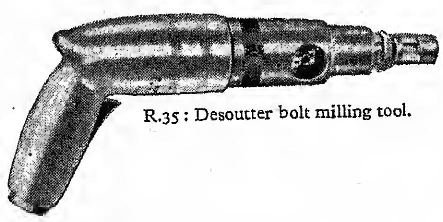
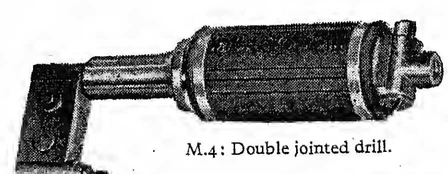


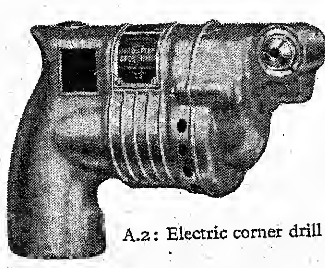
R.2/45: $\frac{1}{4}$-inch Rotor drill.



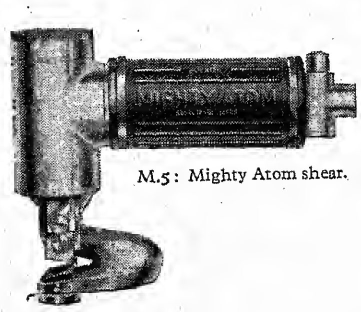
R.35: Desoutter bolt milling tool.



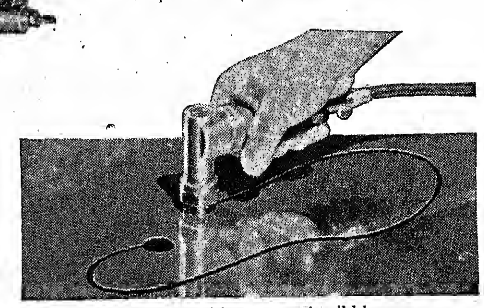
M.4: Double jointed drill.



A.2: Electric corner drill gun.



M.5: Mighty Atom shear.



P.12: Portable pneumatic nibbler.

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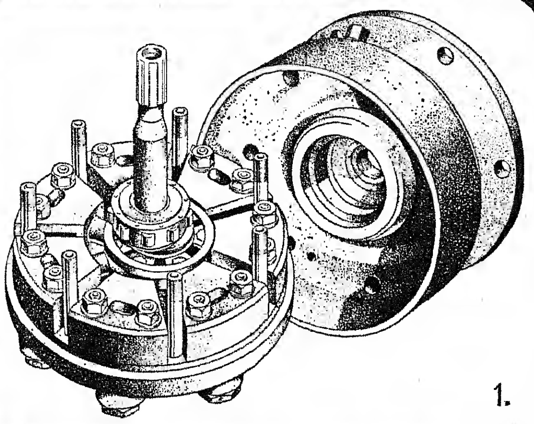

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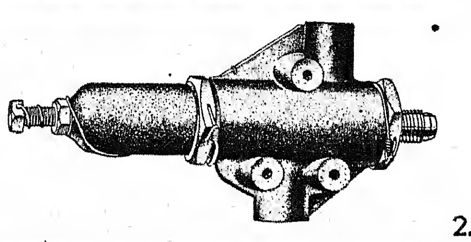

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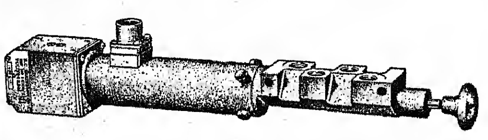

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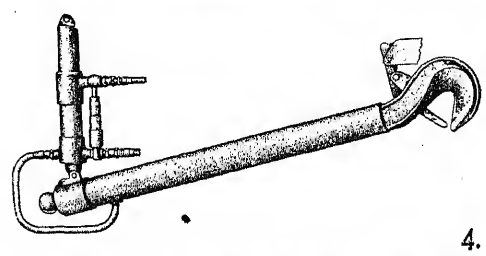

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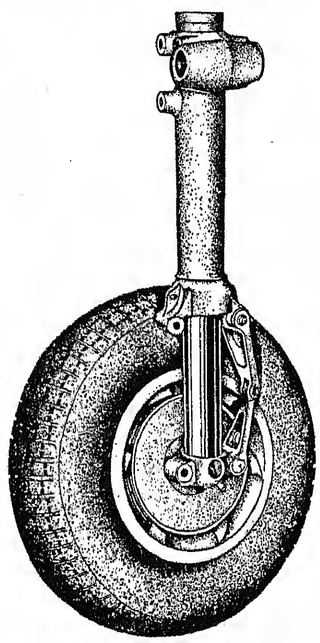

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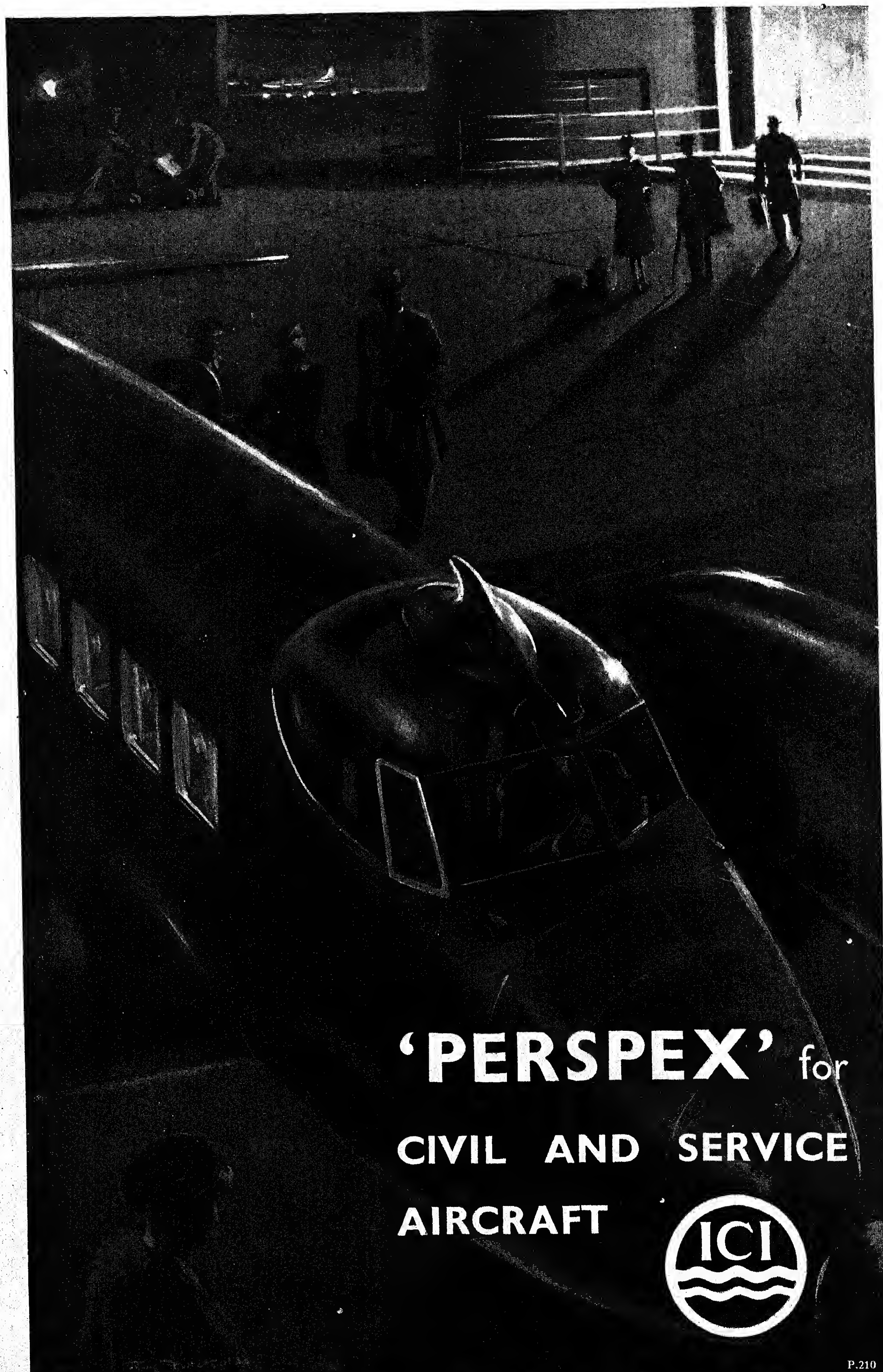
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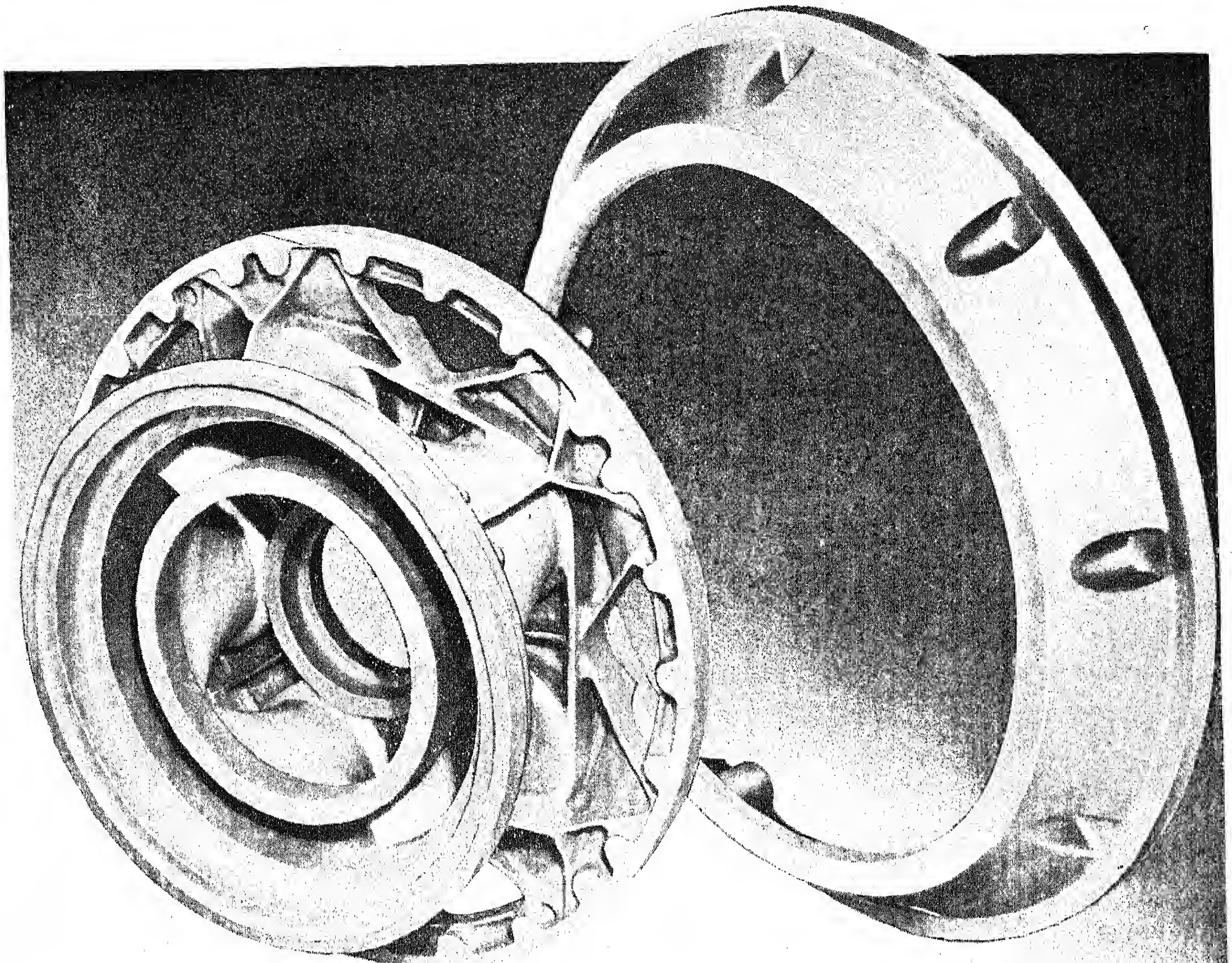

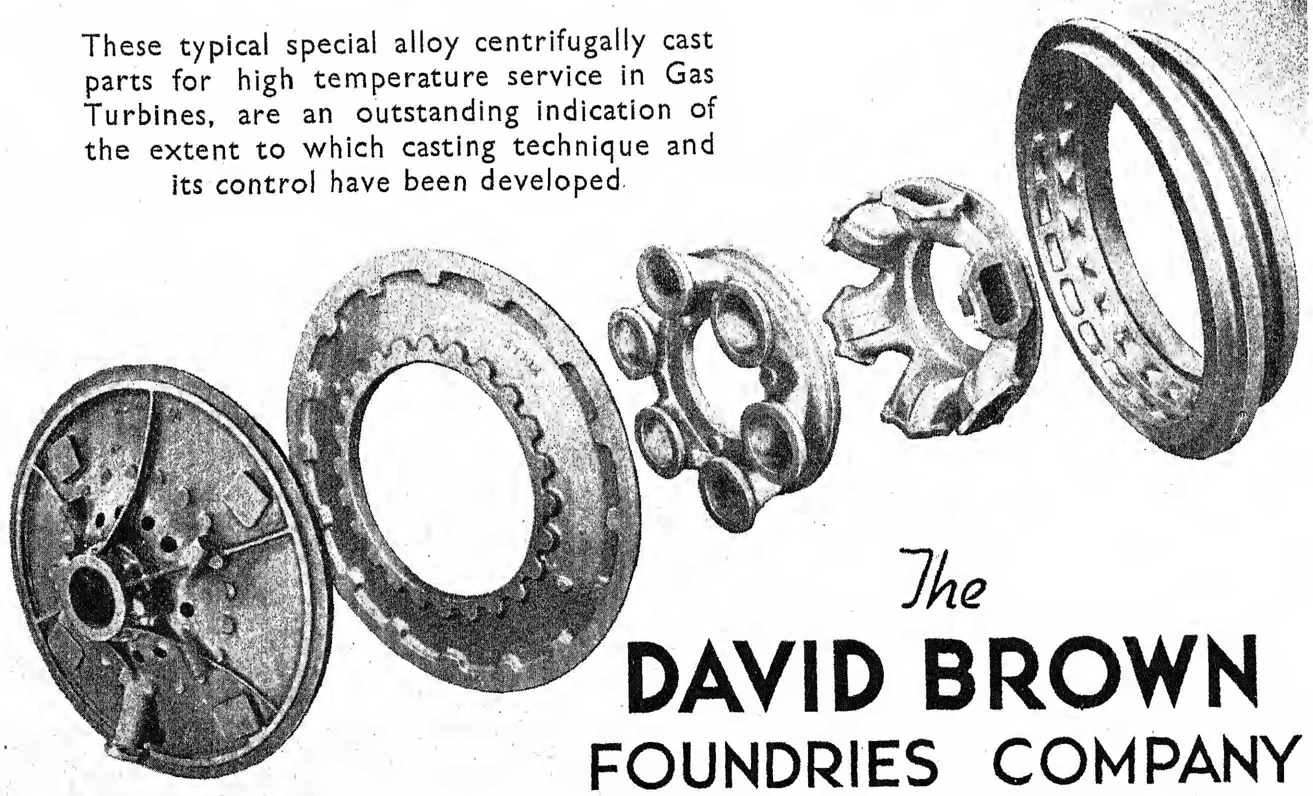


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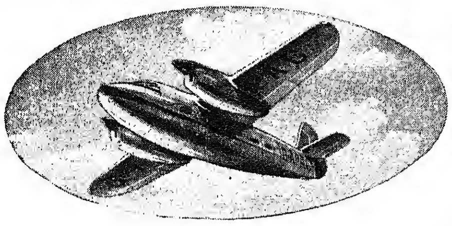

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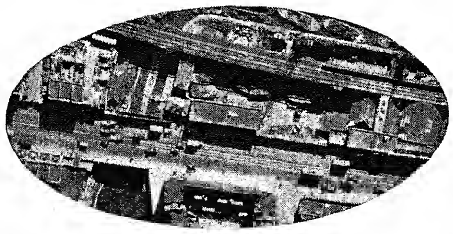

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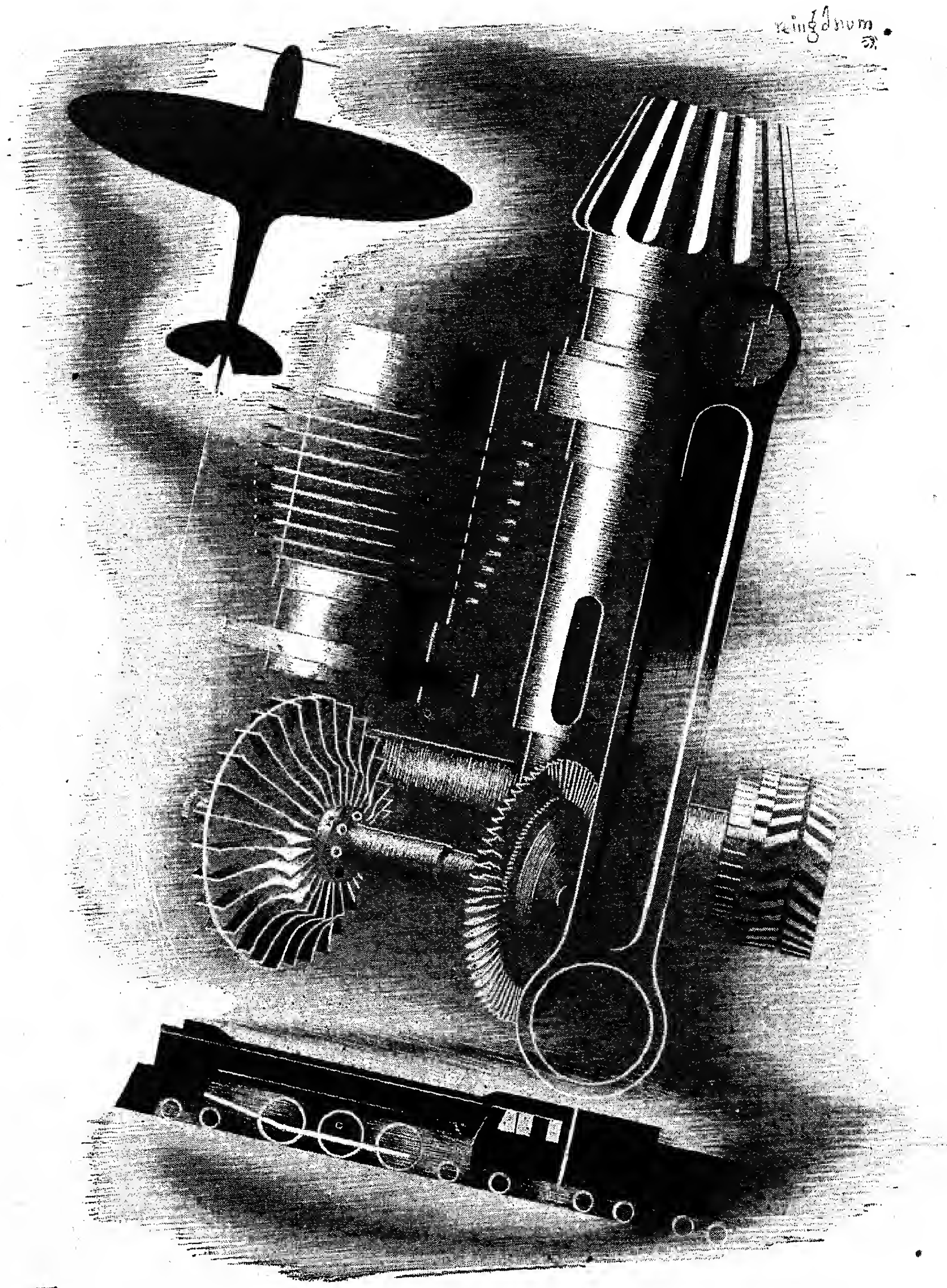

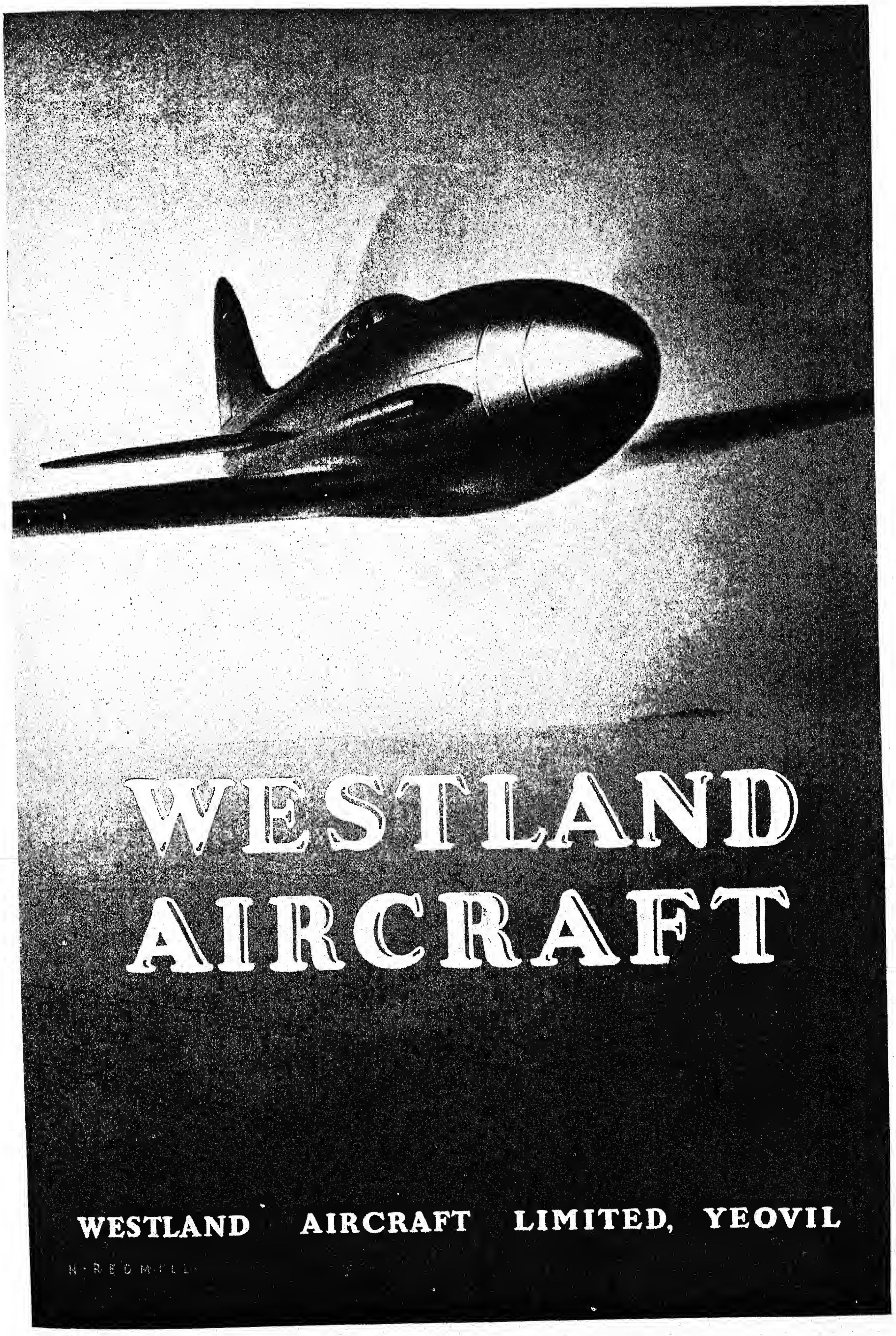
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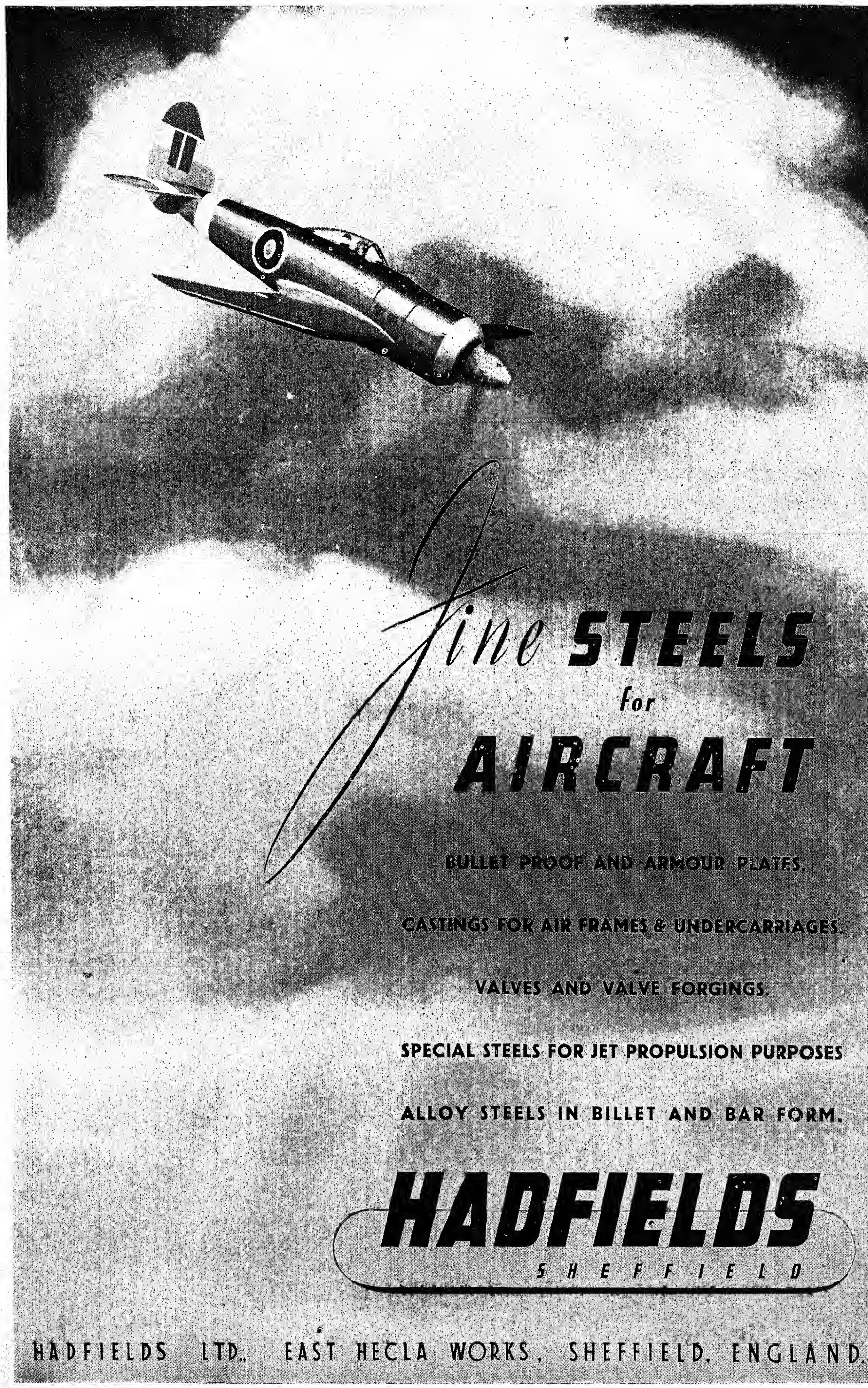
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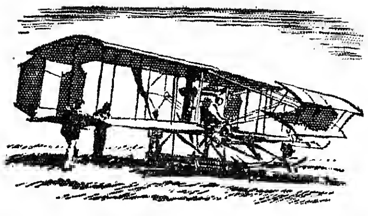
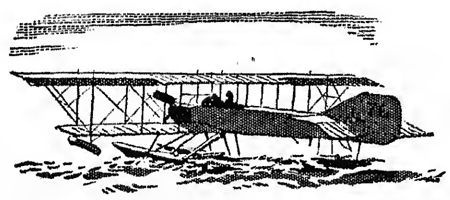


Short No. 1, built in 1908, a biplane with front elevator and wing-tip rudders.

The Short story started in 1908, when Oswald and Eustace Short, already internationally famous balloon-makers, began their experiments with heavier-than-air machines. In the same year, Short No. 1 was built. In 1909 Mr. Moore Brabazon (now Lord Brabazon of Tara) flew Short No. 2 to win the Daily Mail prize of £1,000 for the first flight of one mile in a closed circuit.

Soon after, Shorts accepted orders for six Wright biplanes. This was the first production order for aeroplanes ever placed in Great Britain. Shorts then reverted to original design, and in 1911 built the first twin-engined aeroplanes in the world. Next year a seaplane was supplied to the Admiralty, marking the beginning of the development of Shorts as a marine aircraft firm.

In 1912 a Short pusher biplane took off from the deck of a warship, a feat which laid the foundation of carrier-borne aircraft as a naval weapon.

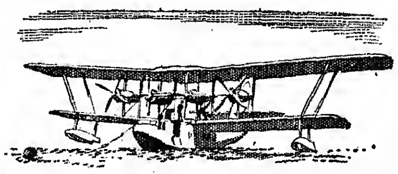


In 1912 the Admiralty purchased this S.41 Seaplane. Mr. Winston Churchill, the First Lord, was one of the first passengers to be carried.

It was seven Short machines that carried out the famous raid on Cuxhaven on Christmas Day, 1914, and during the years that followed, great developments were made in the design and production of service aircraft, including the first torpedo-carrying seaplane.

By 1919 Oswald Short was experimenting with "stressed-skin" construction, and the "Silver Streak," built on this principle, was exhibited in 1920. Four years later the first Short all-metal flying boat was made, and, soon after, their first all-metal light landplane.

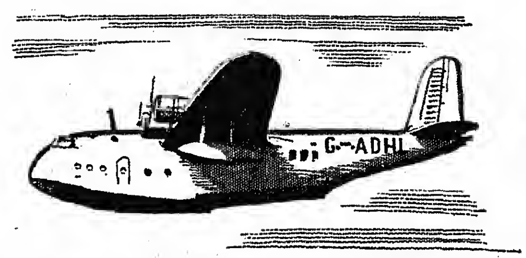
Development work then resulted in the Singapore I, which can be regarded as the forerunner of the great flying boats of today. This was in 1927. The Calcutta fifteen-passenger boat followed, then the four-engined Scipio, the six-engined Sarafand, and the Scylla and Syrinx landplanes, until, in 1935, an order for 28 flying boats was placed by Imperial Airways.



The first of the large flying boats, the Kent (Scipio), used by Imperial Airways on Mediterranean routes.

This order, of great Imperial significance, resulted in the famous Short Empire Class boats.

Maia, the lower component of the Short-Mayo composite aircraft, was derived from the Empire flying boat. So, too, were the magnificent Sunderlands, which gave such outstanding service during the war. And from the Sunderland, in turn, has been developed the Short Sandringham, the most popular flying boat in the world today.



One of the famous Empire flying boats. Twenty-eight were ordered in 1935. Some of them are still in service.

This year the trend to flying boats will be increasingly apparent, as more and more Sandringhams go into Service. Short Solents will also, in large numbers, bring a new standard of luxury to the world's largest air routes. And, finally, the giant Short Shetland will demonstrate beyond question the outstanding advantages of the flying boat to air-line operators, crews, and passengers alike.

Shorts

The first manufacturers of aircraft in the world · Established 1908

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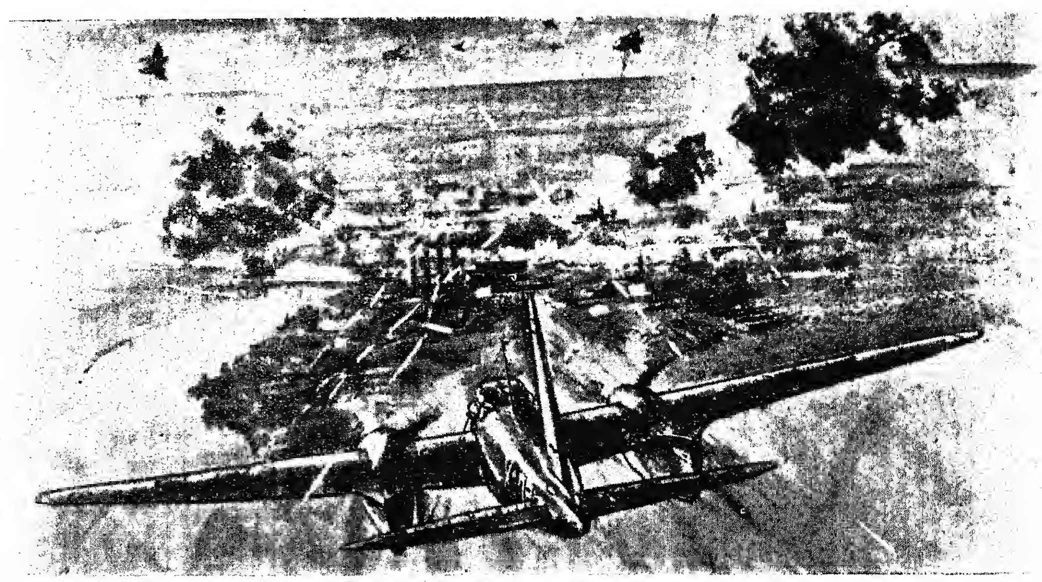
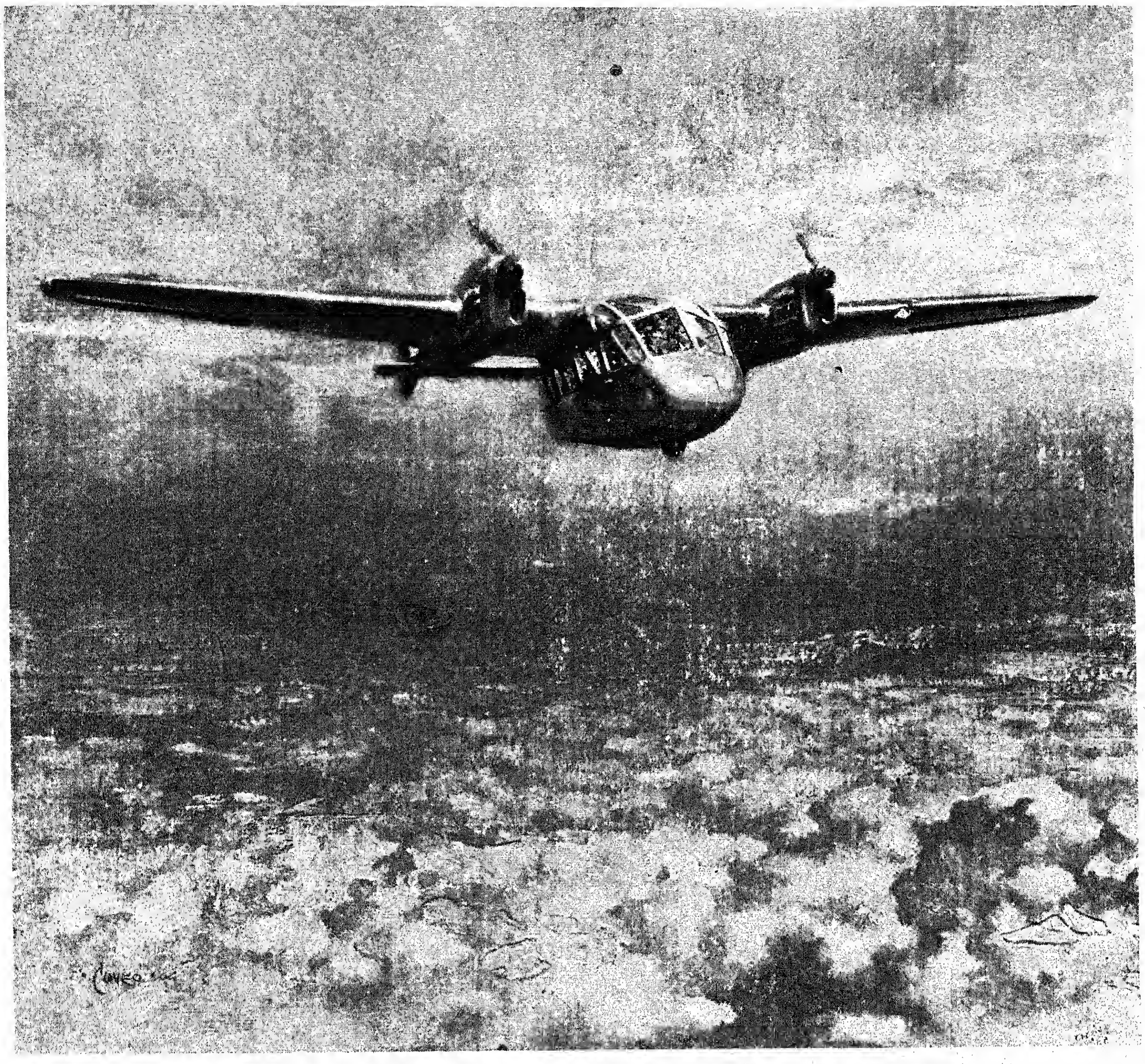
Short & Harland Ltd., Belfast



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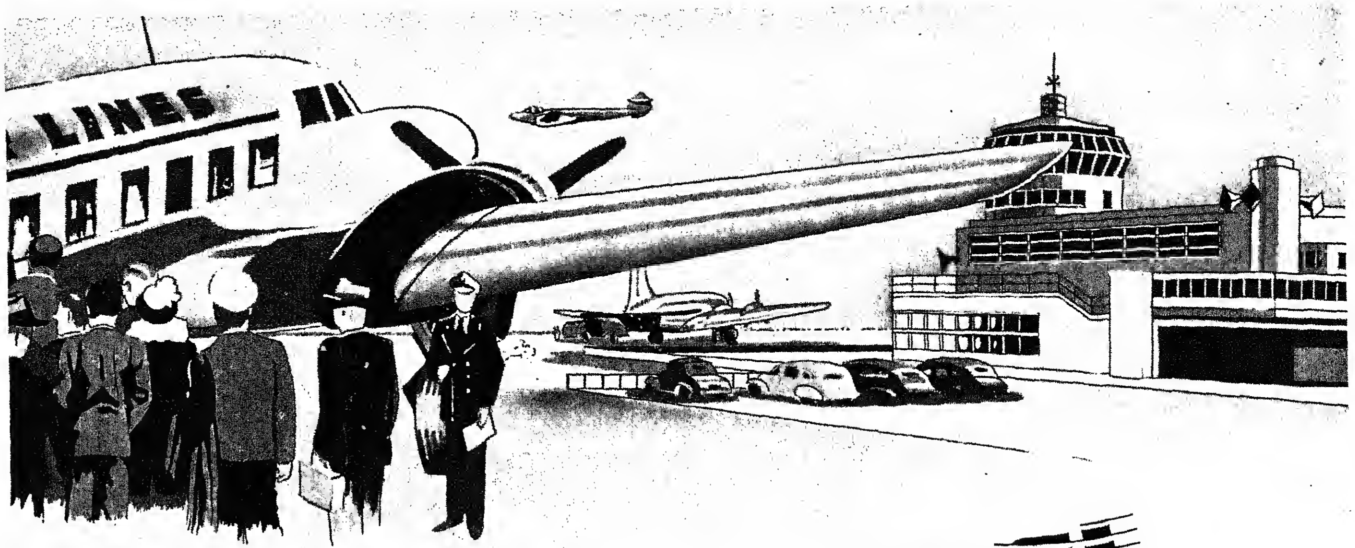
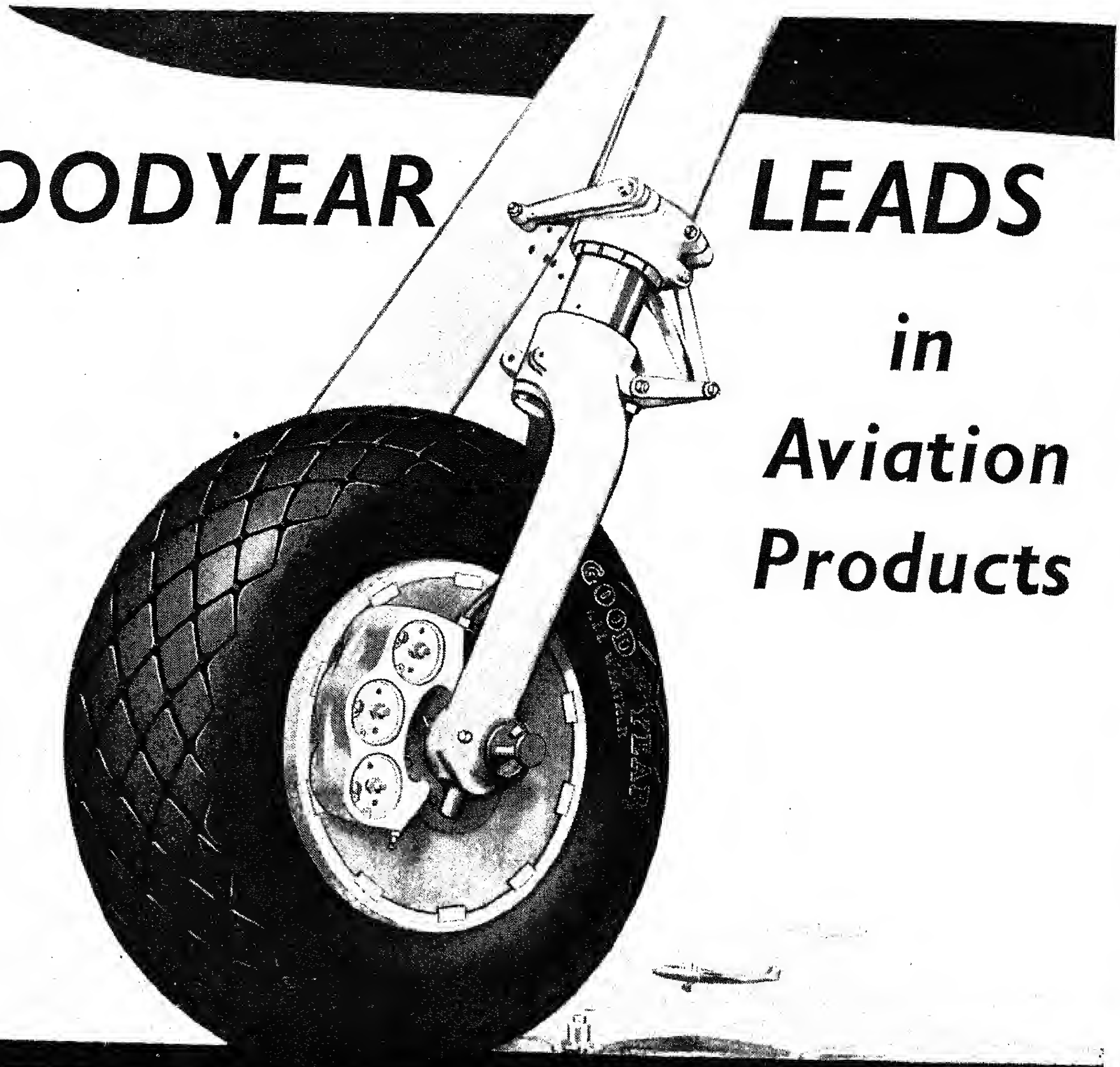

LINES

GOODYEAR LEADS in Aviation Products



GOODYEAR'S single disc brake and wheel assembly, illustrated above, is the latest evidence of Goodyear's leadership in aviation products, a leadership which started in the early days of flying and has been maintained by a long line of "firsts" ever since. That is why to-day the world's most progressive aircraft manufacturers look to Goodyear for the latest technical developments in tyres, tubes, wheels, brakes and a score of other parts and accessories. Goodyear's standards of research ensure that a Goodyear aviation product is as reliable and efficient as the machine it is designed to fit.

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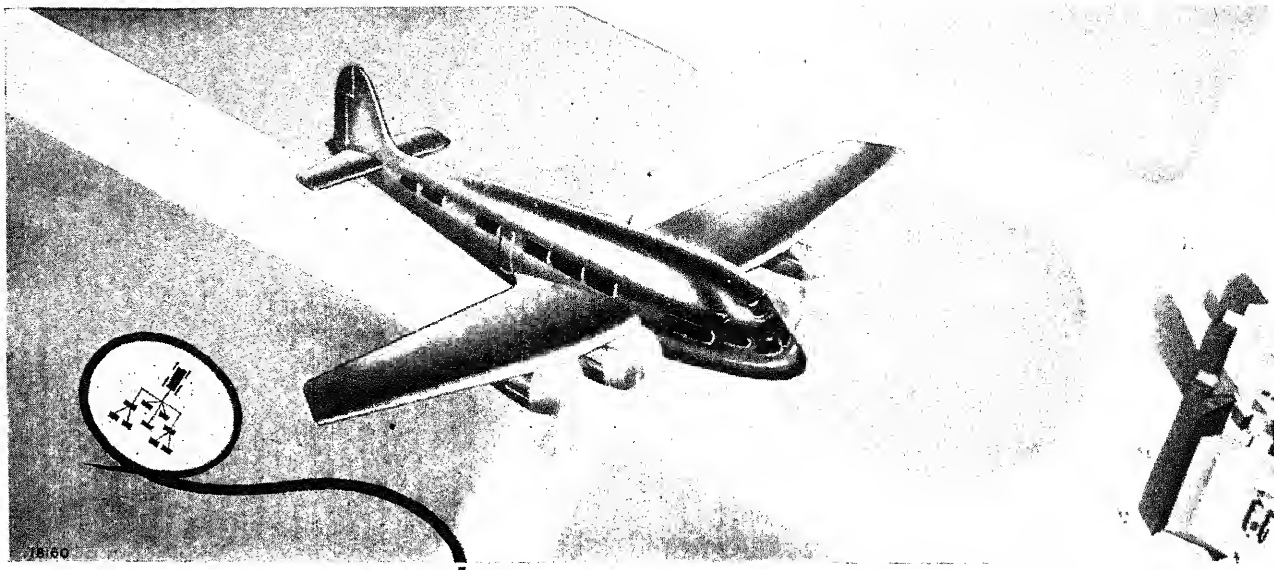
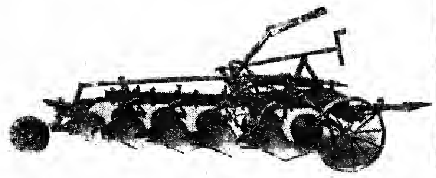


AERODROME MAINTENANCE



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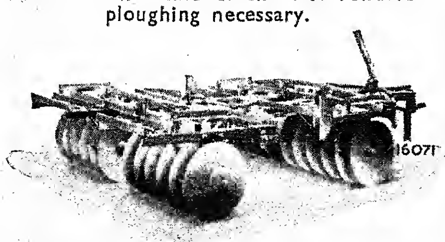
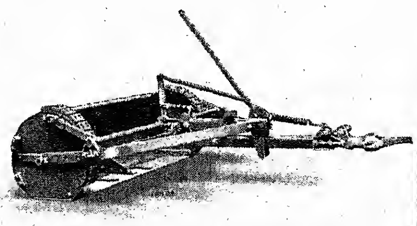


DISC HARROWS. For preparing the soil after ploughing and before sowing grass, these double disc harrows, drawn by a tractor are unequalled.



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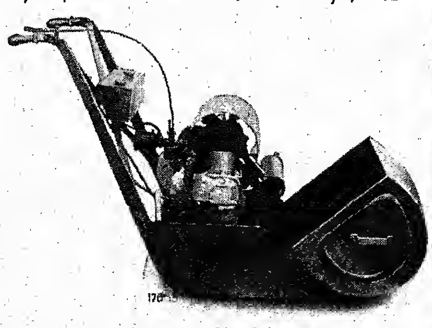

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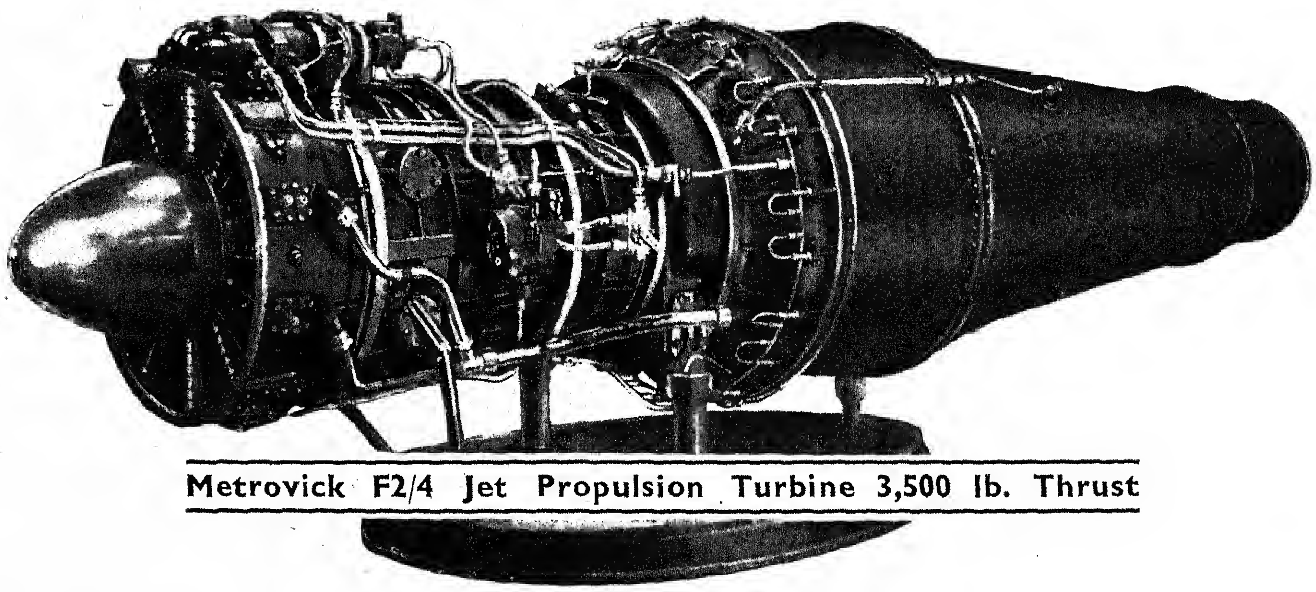

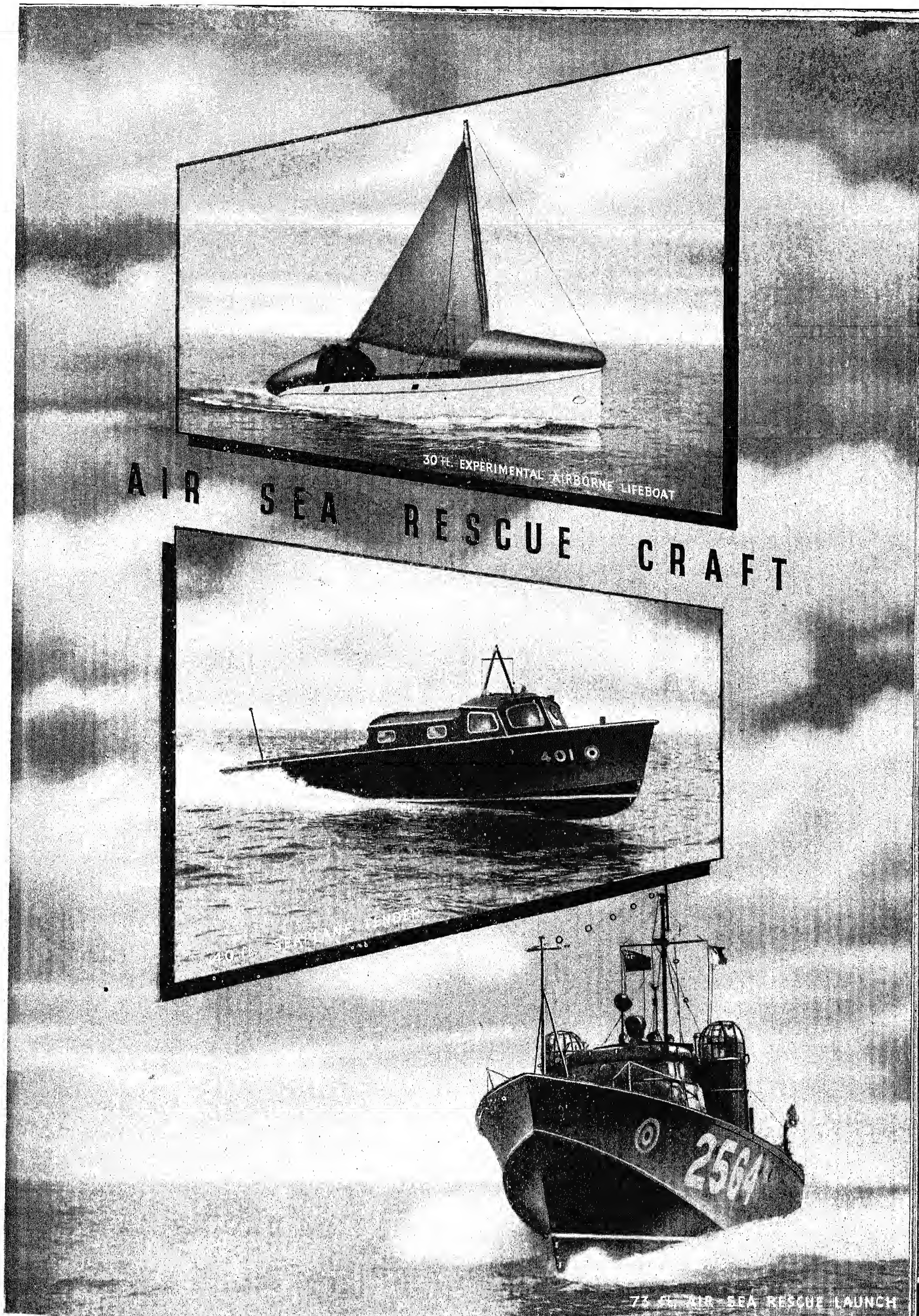
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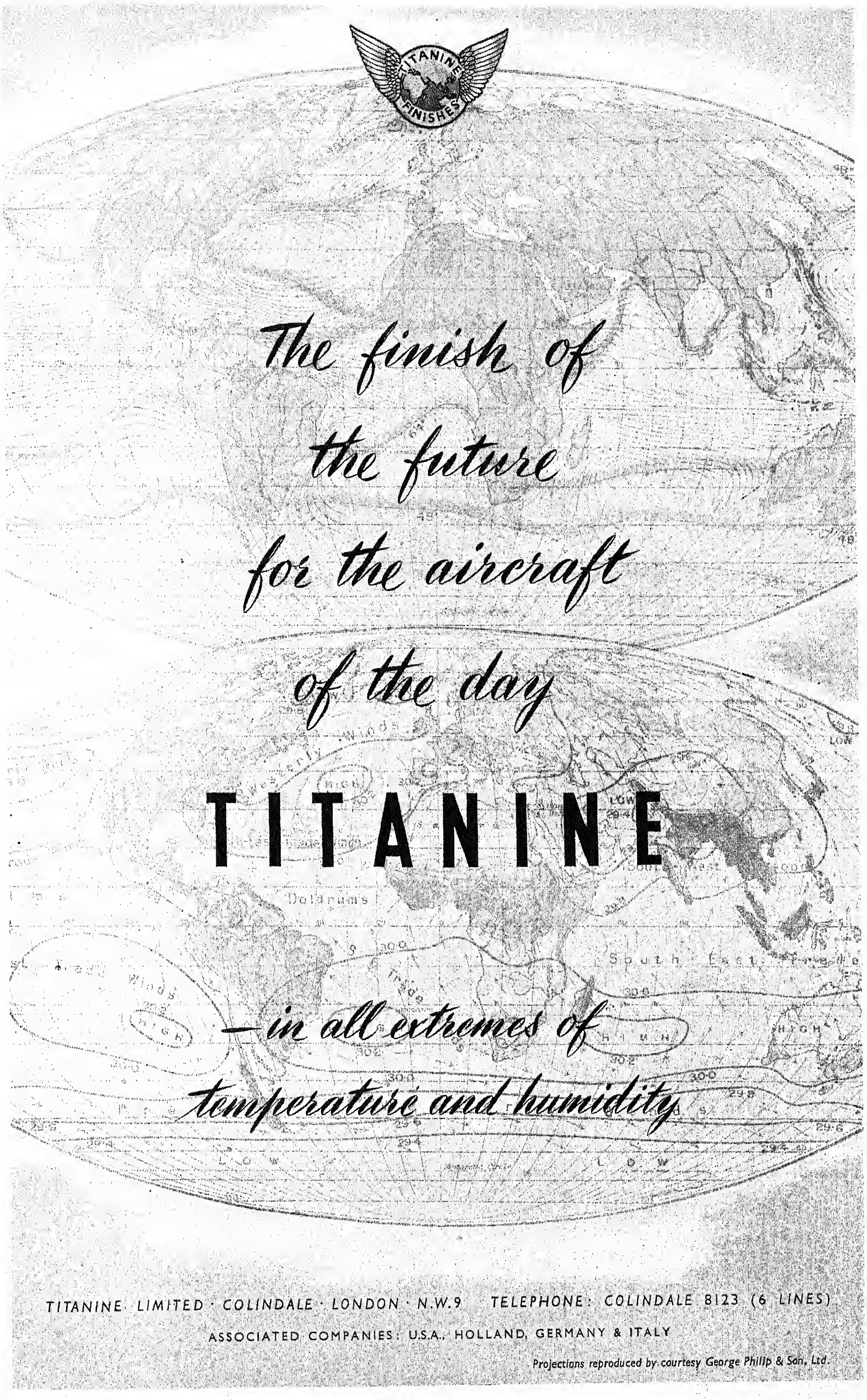
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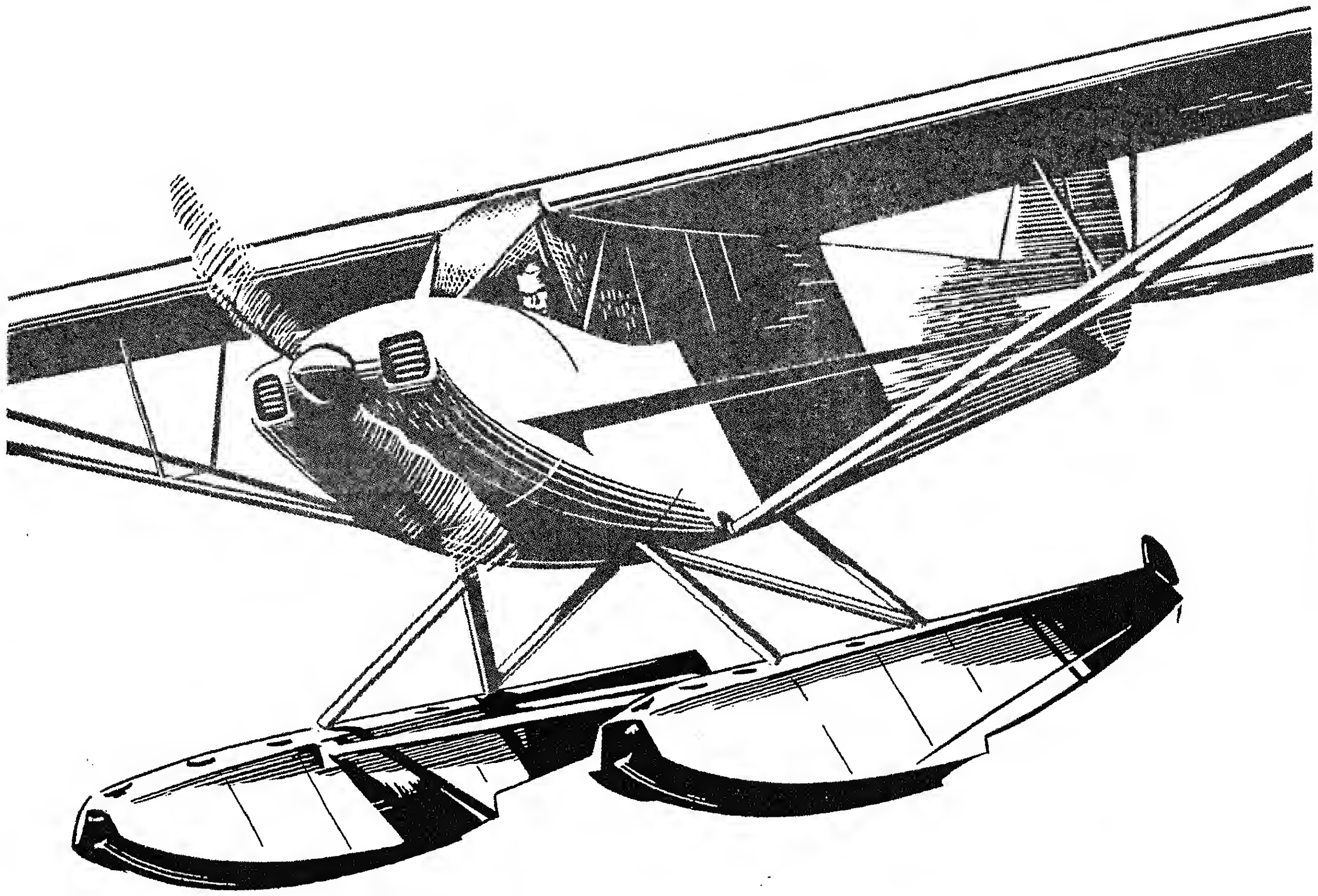

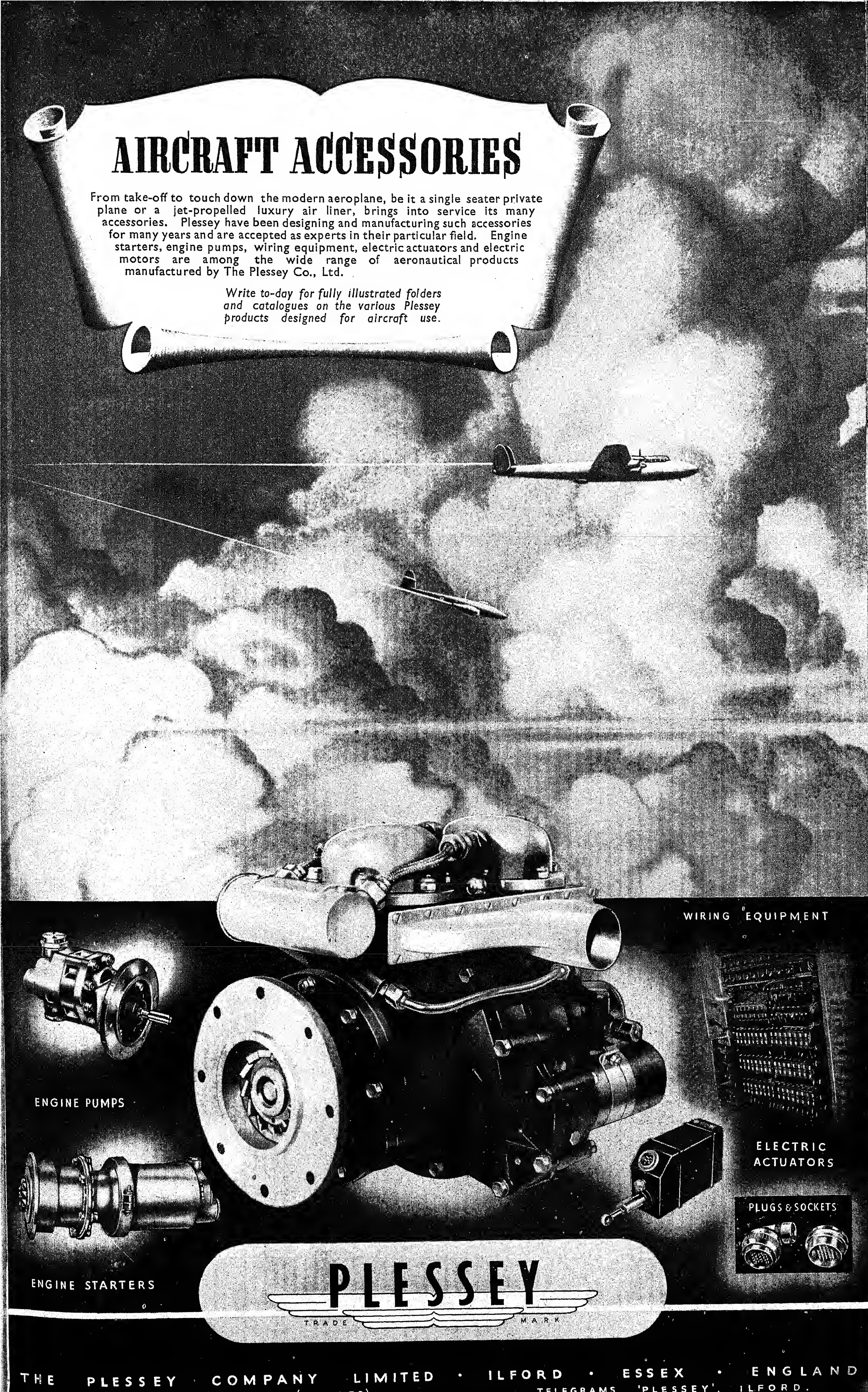
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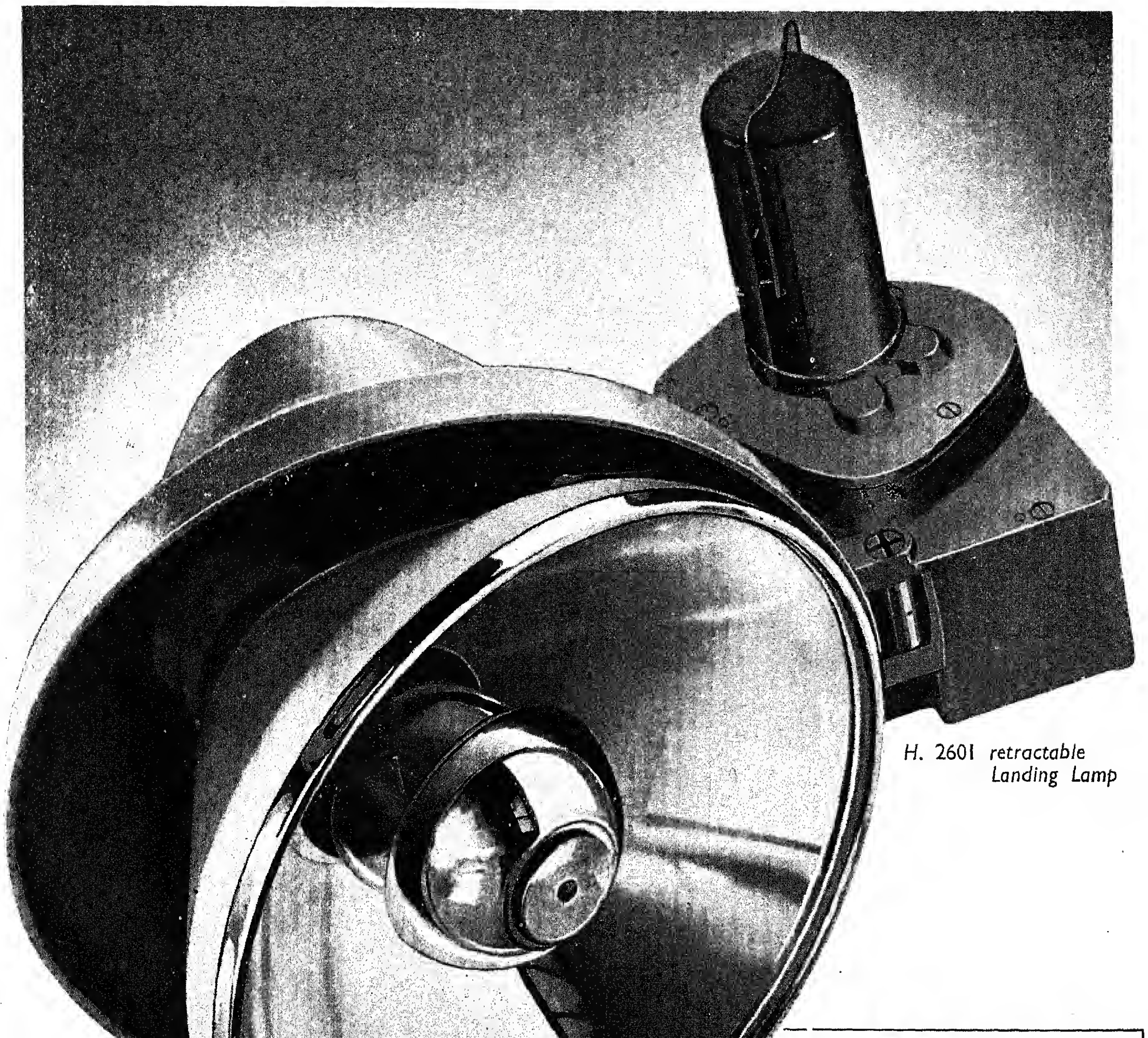

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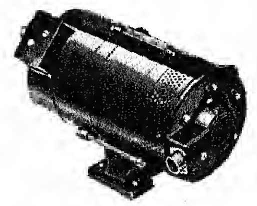

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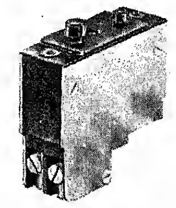

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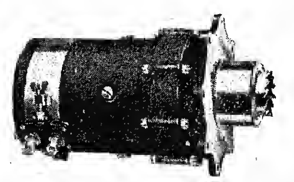

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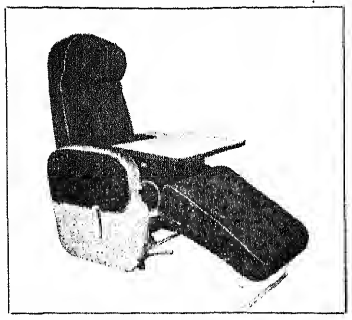

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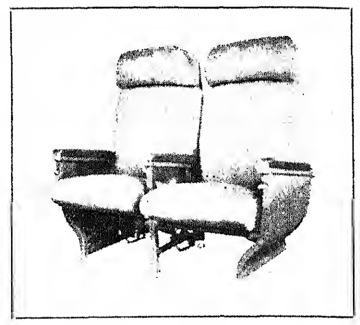

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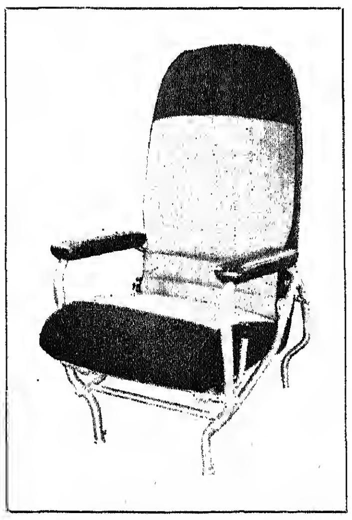

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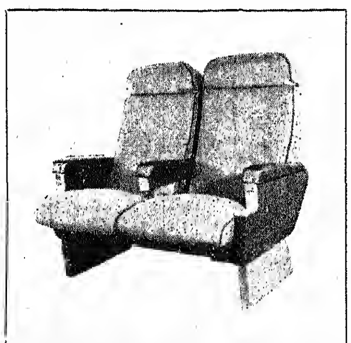
Beech Aircraft Model 18



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Union Southern Air Lines
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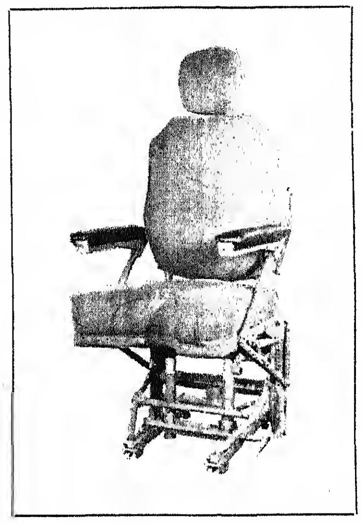

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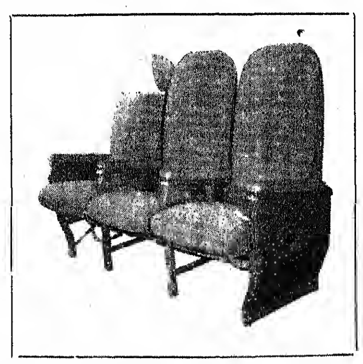

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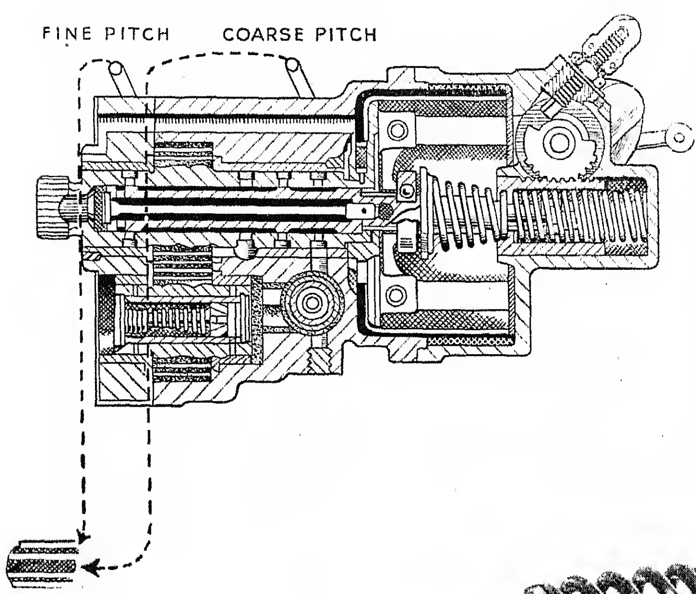

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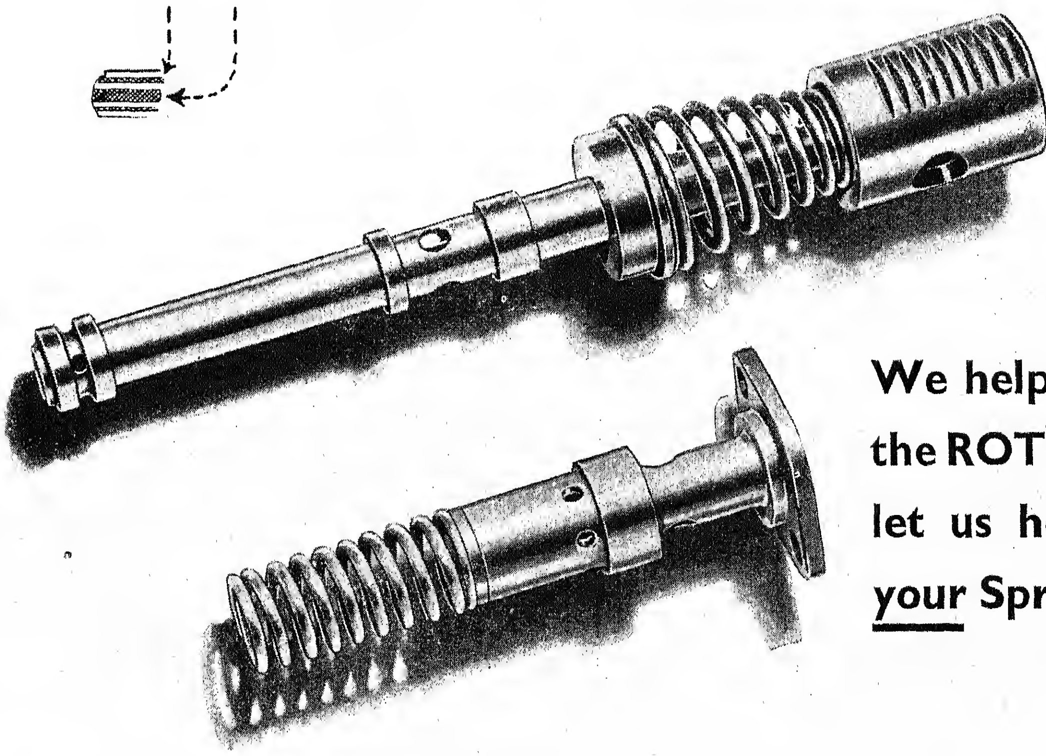

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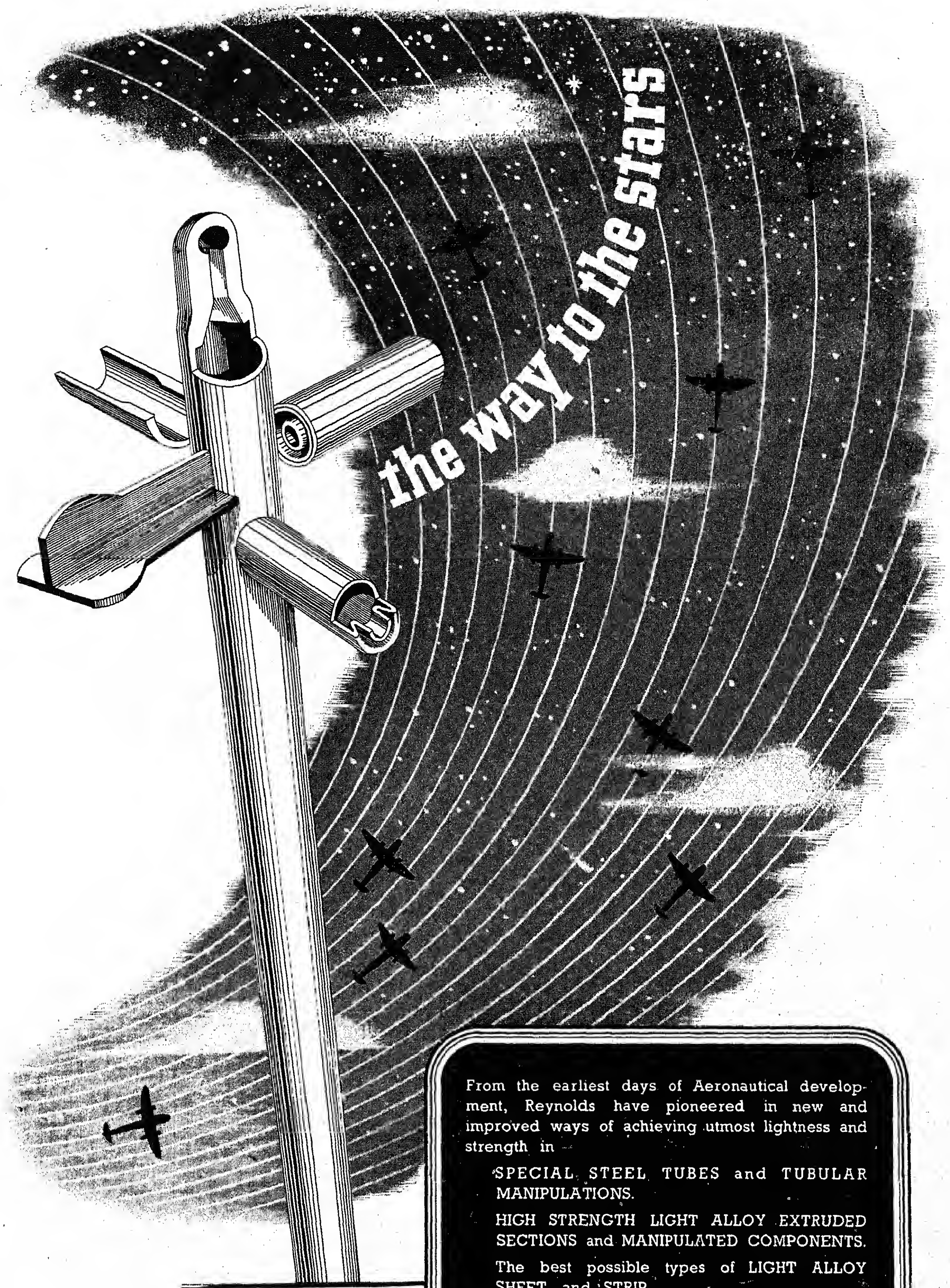
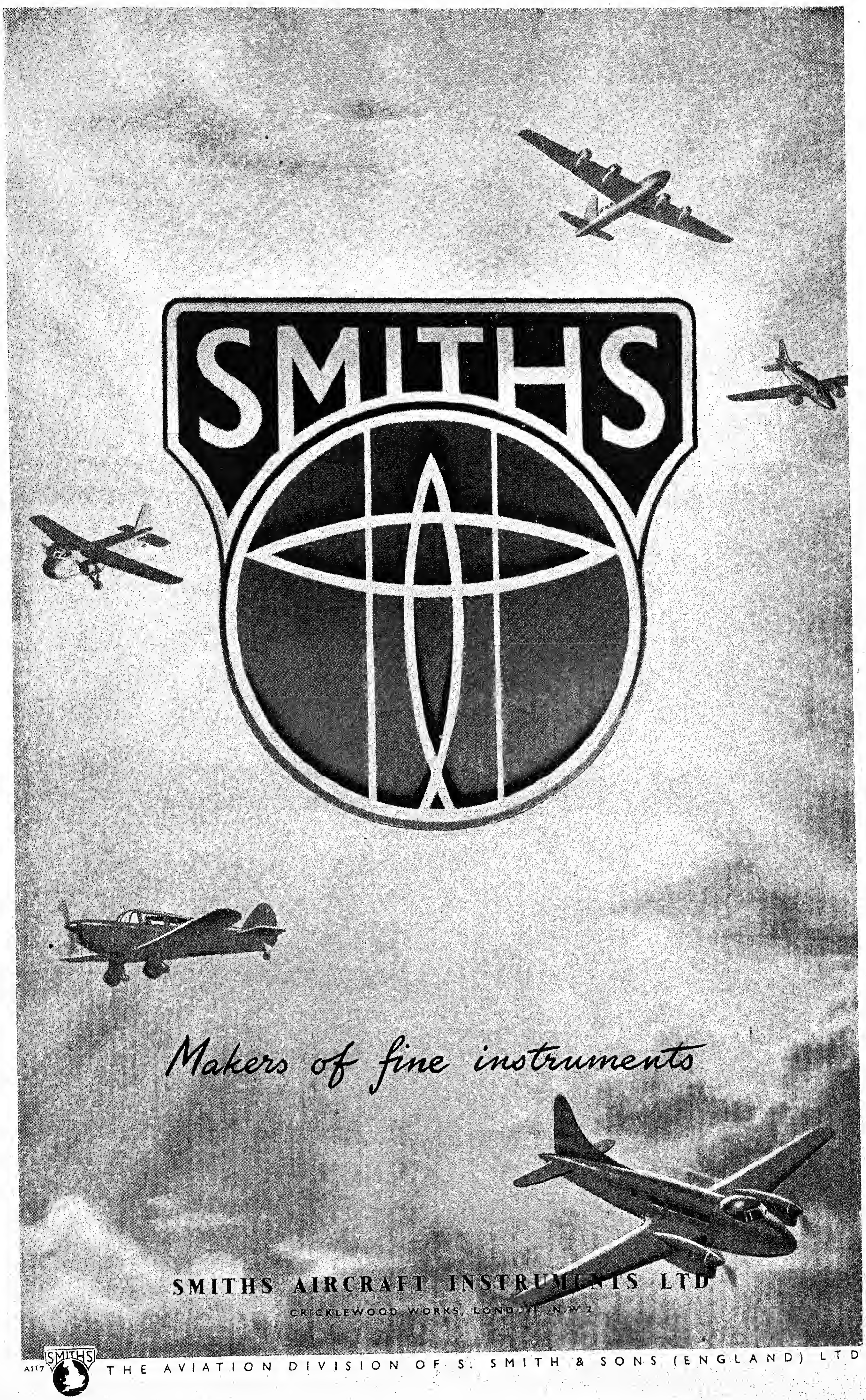

the way to the stars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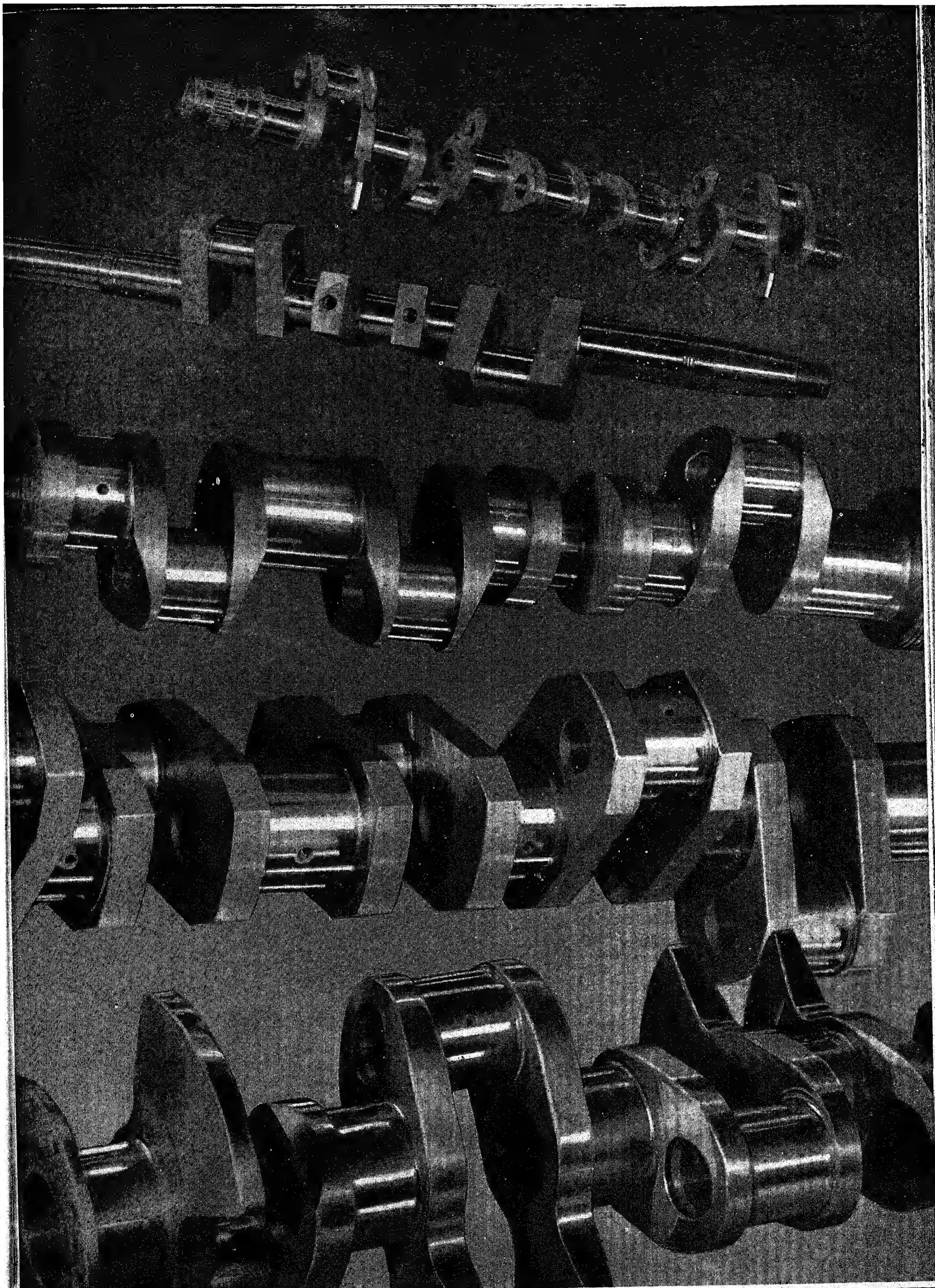

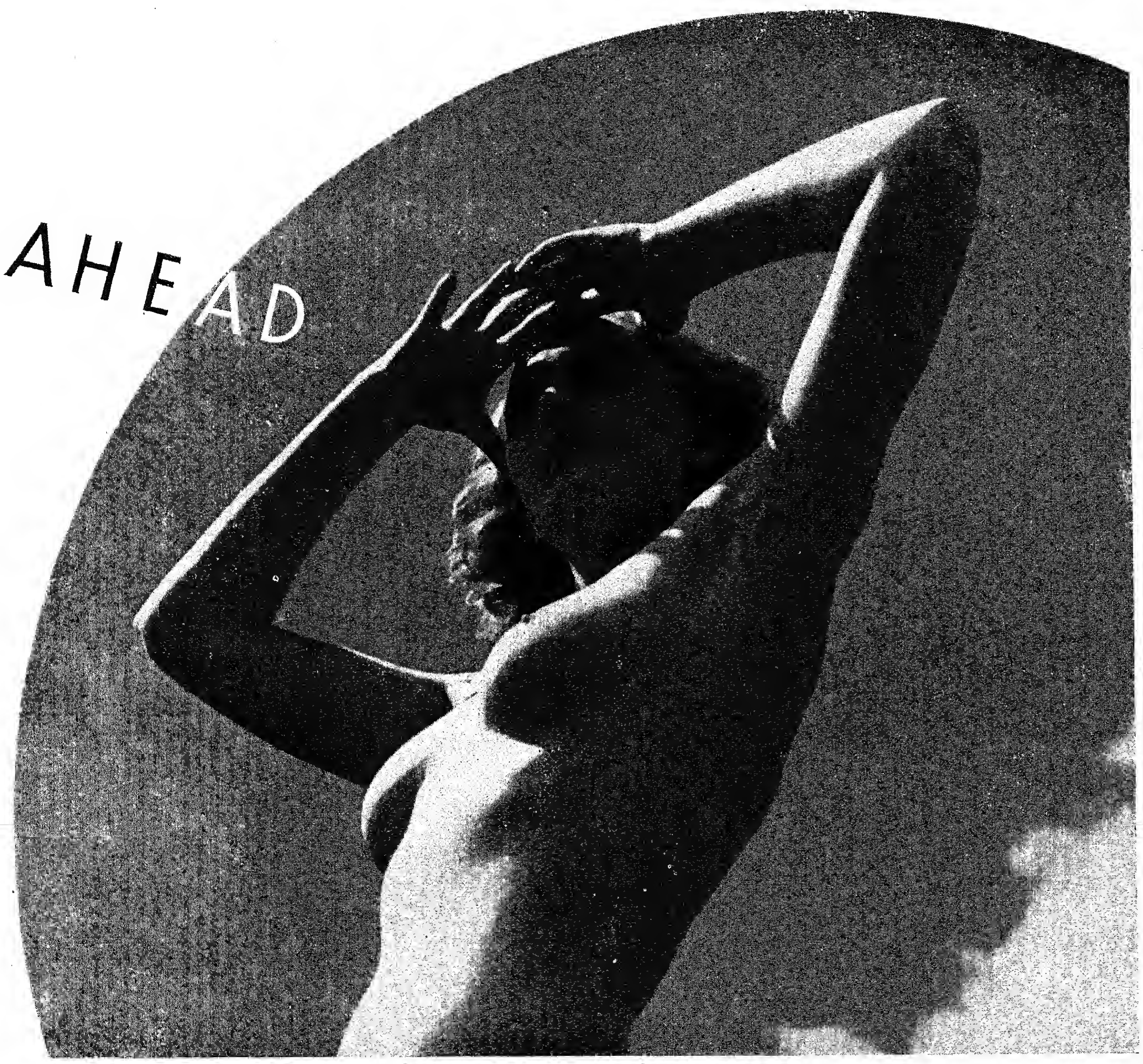
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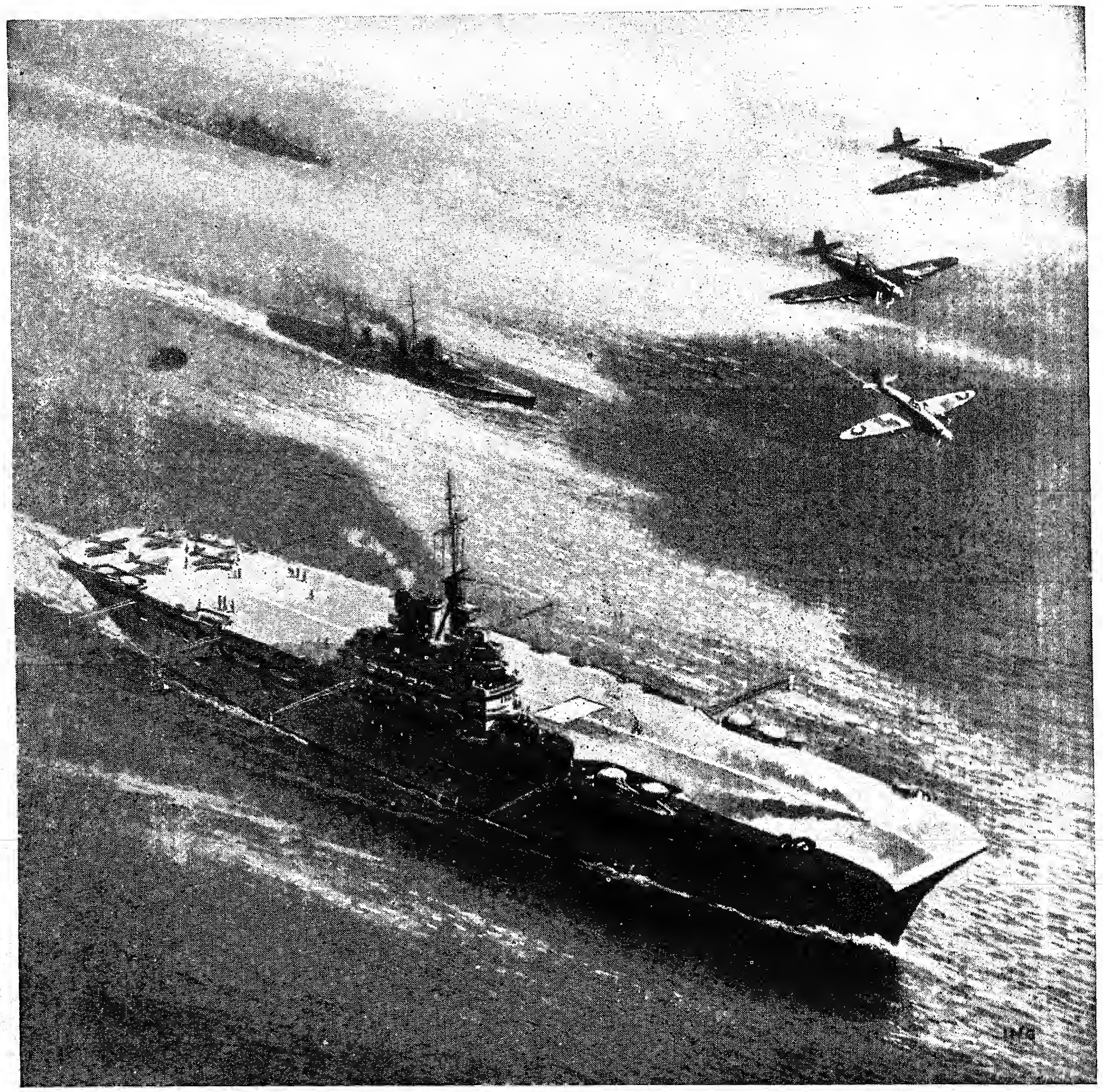

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ALL THE WORLD'S
AIRCRAFT

1947

(Issued August 1947)

THIRTY-FIFTH YEAR OF ISSUE

COMPILED AND EDITED BY
LEONARD BRIDGMAN

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CONTENTS

PART B.

HISTORICAL (Civil Aviation)—

PART C.

PART D.

PREFACE

It is customary to round off the editing and compilation of each edition of "*All the World's Aircraft*" with a brief summary of the contents in which some of the more interesting statistics concerning the volume may be presented in concise form.

In a total of 446 pages, Part A (Service Aviation) occupies 24 pages; Part B (Civil Aviation) 41 pages; Part C (Aeroplanes) 297 pages; and Part D (Aero-engines) 84 pages. The entire book has been completely revised and re-set and of a total of 630 illustrations 548, or 87 per cent., are new—the highest percentage which has ever been recorded.

THE AEROPLANE AND ENGINE SECTIONS.

The largest Section, as always, is Part C (Aeroplanes) with 297 pages and 513 illustrations, of which 461 are new. The absence of Germany and Japan, which last year occupied together some 74 pages, is counterbalanced by increases in the number of pages devoted to nearly every other aircraft-manufacturing country. France increases from 4 to 31 pages with 55 illustrations, all new: Great Britain from 75 to 82 with 148 illustrations, 127 new; the United States of America from 119 to 124 pages with 223 illustrations, all but 12 new; Czechoslovakia from nothing to 6 pages with 11 illustrations. Other increases include Argentina, Australia, Belgium, Canada, Denmark, Italy, the Netherlands, Sweden, Switzerland and Turkey.

Many countries which, except for token recognition, were absent from the pages of the Aeroplane Section during the war have now returned, notably France, Belgium, Czechoslovakia, Denmark and the Netherlands, but there are still a few absentees whose activities, if any, are now shrouded in mystery within boundaries that encompass the Russian sphere of influence or domination. Little or no information is available about the revival of aircraft manufacture in Bulgaria, Poland, Rumania and Yugoslavia.

For the first time for five years it is possible to publish considerable information on many new types of civil aircraft, some of which have already flown in prototype form and will be going into service in 1947. Relaxation in the need for security also makes it possible to give much more information on military types, and also accelerates the release of preliminary data on new aircraft. Of the many aeroplanes which carry over from last year, their description has been completely revised and considerably augmented.

One point which I should like to emphasise here concerns the presentation of all figures and statistics in both Part C (Aeroplanes) and Part D (Aero-engines). In the Preface of the first edition of "*All the World's Airships* (*Aeroplanes and Dirigibles*)" published in 1909, thirty-eight years ago, Mr. Fred T. Jane wrote "This book being more or less international in character, it has been deemed advisable to give metric as well as English measurements in the vast majority of statistics." This practice has been faithfully followed throughout the years, as has the founder-editor's other admirable dictum—that "attention be mainly directed to securing complete accuracy of such figures as are published." The conversions of thousands of figures to their metric equivalents, or *vice versa*, is a task in itself but it is one which has always been considered to be an essential part of the editorial programme.

Part D (Aero-engines) occupies 84 pages and has a total of 117 illustrations, of which 87 are new. The elimination of Germany and Japan is offset by the reappearance of France and Czechoslovakia, and increases in the number of pages devoted to Great Britain, the United States and Italy.

The last edition was notable for, among other things, the first extensive reference to the pioneer work in turbo-jet engines undertaken in Great Britain before and during the war, including much valuable historical information on the work of Air Cdre. Whittle and the achievements of such firms as Armstrong Siddeley, de Havilland, Metropolitan-Vickers, Rolls-Royce and Power Jets, Ltd. (as it then was). The end of the war in Europe just before the 1945-46 edition was due to go to press also made it possible to incorporate at the last moment additional information on a parallel development in jet engines carried on in Germany during the war. Security restrictions, however, prevented the inclusion of details of American jet development at that time.

This year it is possible to give much more data on jet engines of both British and American origin and to make brief reference to development that is now in hand in France. The progress which has been made in jet-propulsion is also reflected in the Aeroplane Section, where many aircraft fitted with turbo-jet power-units are illustrated and described.

One aspect of the superiority of the jet engine was demonstrated in 1945 when a Gloster Meteor with two Rolls-Royce Derwent turbo-jet engines raised the World's Speed Record to 606 m.p.h. (970 km.h.), an increase of nearly 140 m.p.h. (224 km.h.) over the previous record made with a special high-performance short-life internal combustion engine. On September 7, 1946, the record was raised to 616 m.p.h. (986 km.h.) by another Gloster Meteor. Both these records were made with an aircraft which in standard form with full armament and combat equipment has a maximum level speed of 585 m.p.h. (940 km.h.), but 31 m.p.h. (50 km.h.) less than the absolute record.

THE HISTORICAL SECTIONS.

The presentation of facts concerning the World's civil aviation has posed a problem which has been difficult to solve. The task of compiling of a work of this size and scope necessarily takes considerable time—time to allow for correspondence to countries all over the World, many of which are still suffering from the aftermath of war; time for the authorities concerned to prepare the information needed and return it to London, often by the slowest means of transport; and time for the translation of such material into a form suitable for publication. The machinery of production also has its difficulties after six long years of war and one and a half years of rigourous peace, resulting in a considerable slowing up of the process of converting the written word to the finished printed page.

Civil aviation to-day is far from static and facts recorded one week may be either inaccurate or completely out-of-date the next. The problem is how to deal with the mass of information available, much of which is known to be of a temporary or fleeting character, for publication in a work whose currency for reference purposes is twelve months.

Historically, it is possible to assemble together a vast mass of material which in bulk alone would be impressive. This year, however, for more than one very good reason, it has been decided to limit the amount of information published to that which includes only the essential reference data concerning the organizational background of civil aviation in all countries of the World.

Government organizations and establishments, associations, scheduled airline operating companies, flying clubs, airports of entry, etc., are detailed, but it has been deemed wise to omit lists of air routes until such time as some degree of stability has been achieved. This alone will permit a reduction of some twelve valuable pages, an important consideration in these austere days of peace, with their shortages and crises.

In Section B (Service Aviation) a considerable saving of space comes automatically with the large reduction in the strengths and fields of activity of the Air Forces of the Allied Nations. This section reverts to its pre-war form with standardised information concerning the Air Forces of every country that supports an organized air arm. The lessons learned in the late war are still being digested and plans for re-organization and re-equipment have yet to be disclosed in many countries. Nevertheless, the picture presented in these pages represents the state of the World's Air Forces as accurately as can be at this time.

ACKNOWLEDGMENTS.

Once again I am glad to acknowledge the help I have received from many different sources, both at home and abroad. For this edition I had, for the first time, the services of an assistant, Mr. H. J. Cooper, who joined me some eighteen months ago. He has worked hard, both editorially and in preparing a considerable number of new three-view drawings, but unfortunately his health has broken down under the strain, and to my regret I am now compelled to lose his services. During the short time he worked with me, his patience, industry and keen sense of detail were of great help.

My thanks are due to the Public Relations Directorate of the Air Ministry and to the appropriate authorities of the Dominion, Colonial and foreign governments for their helpful co-operation. I would also like to express my appreciation for the help I have received from the technical and publicity officials of the aircraft and aero-engine industries of the World, and to thank the many correspondents who send me information and photographs. Among these correspondents I would particularly like to mention Messrs. Harold Martin, Morton Kelman, Peter Bowers, Gordon Williams, William Larkins, Edgar Diegan and Boardman Reed, whose excellent photographs of aircraft have offered me a wide choice of illustration for the American pages of the Aeroplane Section.

L.B.

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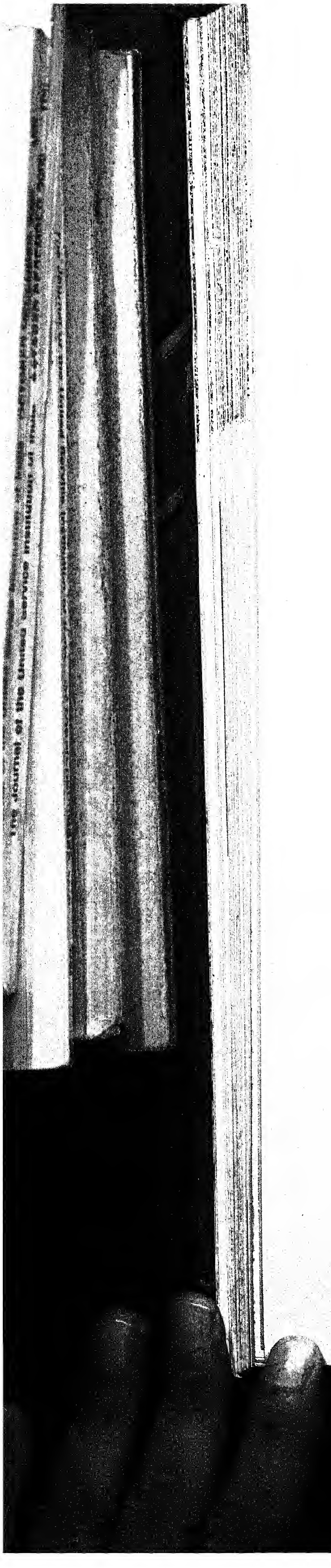
PART A

A
REVIEW OF THE WORLD'S
AIR POWER

ARRANGED IN
ALPHABETICAL ORDER OF NATIONS

A RECORD OF THE ARMY AND NAVY AIR SERVICES AND OF THE INDEPENDENT AIR FORCES OF ALL NATIONS DURING 1946, TOGETHER WITH DETAILS OF THEIR ORGANIZATION AND THE ADDRESSES OF THEIR VARIOUS DEPARTMENTS AND COMMANDS


The Journal of the United Service Institution of India

HISTORICAL (SERVICE AVIATION)

AFGHANISTAN

(The Kingdom of Afghanistan)

NATIONAL MARKINGS

THE AFGHAN AIR FORCE

The Afghan Air Force is an integral part of the Army under the administration of the Ministry of War. The Commandant of the Air Force, Firqa Mishar (Major-General) Muhammad Ihsan Khan, is responsible to the Minister of War through the Chief of the General Staff of the Ministry of War.

ORGANIZATION

The units of the Afghan Air Force come directly under the disciplinary control of the Commandant of the Air Force and are normally concentrated at the Kabul (Sherpur) Aerodrome, the Headquarters of the Air Force.

TRAINING

There is a small Flying Training School and an Engineering School at Kabul, with capacities for nine student pilots and nine mechanics respectively. A Royal Air Force officer is attached to the Afghan Air Force for general instruction and performs the duties of pilot instructor for the Flying Training School.

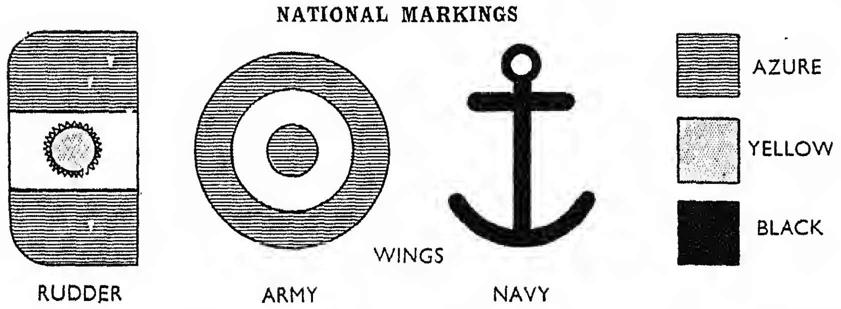
ALBANIA

Little is known other than that an Albanian Air Force exists and that it is under Russian control. It is believed that several Albanian pilots were trained by the Jugoslav Air Force in the Summer of 1946.

ARGENTINA

(The Argentine Republic—República Argentina)

NATIONAL MARKINGS



On January 4, 1945, a Ministry of Aeronautics was established in Argentina to co-ordinate and administer all matters concerning Military and Civil Aviation, with the exception of the Naval Air Service, which continues under control of the Ministry of Marine. The responsible Minister is Brigadier Bartolome de la Colina.

ORGANIZATION

Secretaria de Aeronáutica (Secretariat of Aeronautics), Avenida Alvear 1419, Buenos Aires.

The organization of the Secretariat (Ministry of Aeronautics) includes :—

(1) Comando de los Fuerzas Aéreas Argentinas (Command of the Argentine Air Forces).
(2) Dirección General de Aeronáutica Civil (General Directorate of Civil Aeronautics).
(3) Dirección de Institutos Aeronáuticos (Directorate of Air Training).
(4) Cuartelmaestre General de Aeronáutica (Department of Material, Works and Buildings).
(5) Instituto Aerotecnico (Technical Research and Development Institute).
(6) Comando de la Defensa Antiaérea (Command of Anti-aircraft Defense).

THE ARGENTINE AIR FORCES

Comando de los Fuerzas Aereas Argentinas.

Officer Commanding: Brigadier Pedro Castex Lainford.

Subordinate to the Comando de los Feurzas Aéreas Argentinas are :—four Military Air Bases, three Air Regiments, one Observation unit, one Transport Group and one Training Group.

The units of the Argentine Air Forces are :—

Air Regiment No. 1. Military Air Base "El Palomar," Province of Buenos Aires.

Air Regiment No. 2. Military Air Base "El Palomar," Province of Buenos Aires.

Air Regiment No. 3. Military Air Base "El Plumerillo," Mendoza, Province of Mendoza.

Reconnaissance Group No. 1. Military Air Base "General Urquiza," Paraná, Province of Entre Ríos.

Subordinate to the Direccion de Institutos Aeronauticos are :—

Escuela de Aviación Militar (School of Military Aviation), Córdoba, Province of Córdoba.

Escuela de Especialidades (School of Specialists for non-commissioned officers), Córdoba, Province of Córdoba.

Escuela de Paracaidistas (Paratroop School), Córdoba, Province of Córdoba.

EQUIPMENT

Fighting :—Curtiss Hawk 75 (Argentine-built).

Attack:—Northrop 8-A2.

Bombing:—Glenn Martin 139, Ae. M.B.2 (Argentine-built).

Reconnaissance:—Junkers K.43, Fairchild 82 (photography).

Training:—Focke-Wulf Fw 44 and Fw 58, (Argentine-built) North American NA-16, Fairchild M-62, DL-22 (Argentine-built).

Transport:—Junkers Ju 52, Lockheed 10E and 12B.

THE NAVAL AIR SERVICE

Naval Aviation is administered by a Director-General of Naval Aviation, who is directly responsible to the Minister of Marine.

ORGANIZATION

Dirección-General de Aviacion Naval, Ministerio de Marine, Austria 2561, Buenos Aires. Director-General: Rear-Admiral Horacio Smith.

ARGENTINA—*continued.*

Under the technical control of the Director-General and the operational control of the Commander-in-Chief of the Fleet are :—

The Puerto Belgrano Naval Air Base (land and sea).
The Punta Indio Naval Air Base (land and sea).
The Naval Air Detachment at Fuerte Barragan.
The Naval Air Detachment at Mar del Plata.
Naval Air Detachment at Madryn.
The School of Naval Aviation at Puerto Belgrano.
Three Air Squadrons.

EQUIPMENT.

Training:—Curtiss-Wright 16E, Stearman 76D1, Vought Corsair O2U-1, Junkers W34, Stinson Reliant.
Reconnaissance:—Vought Corsair V-142 and V-65F, Grumman G-15 and G-21, Supermarine Walrus.
Bombing:—Glenn Martin 139W.
Patrol:—Consolidated P2Y-3.
Transport :—Fokker, Douglas Dolphin, Consolidated Fleetster, Curtiss-Wright Condor.
General Purposes :—Fairchild 82, Fairchild 45, Lockheed Electra 10E.

BELGIUM

(The Kingdom of Belgium—Royaume de Belgique)

THE BELGIAN AIR FORCE

From October, 1940, when the Belgian Government was re-constituted in London and the Belgian armed forces were re-formed in the United Kingdom, to September 1, 1946, the Belgian Air Force was maintained in the form of a Belgian Section of the Royal Air Force Volunteer Reserve. Apart from Belgian pilots and airmen who served in R.A.F. units in all theatres of war, two Belgian fighter squadrons were formed, the first in Great Britain in November, 1941, and the second in West Africa in 1943. The first squadron served throughout the war with Fighter Command and the second squadron was ultimately transferred to the United Kingdom to serve with the R.A.F. 2nd Tactical Air Force. After the liberation of Belgium an elementary flying training establishment was set up in England and personnel recruited in Belgium were sent to England for training.

On September 1, 1946, the agreement with the British Air Ministry terminated and the Belgian Air Force became an independent unit under the direction of the Ministry of Defence, Brussels.

Initially, the Belgian Air Force will consist of :—

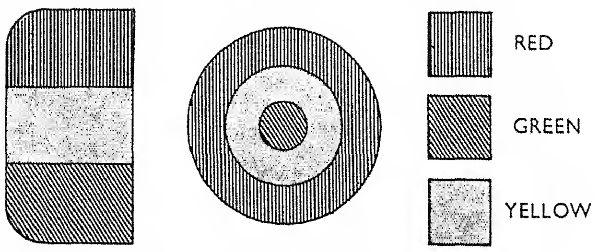
General Headquarters, Belgian Air Force. Etterbeek, near Brussels.
Chief of Staff : Colonel Lucien Leboutte.
Four Operational Squadrons, based at Beauvechain, Florenne and Brusthem.
Tansport Wing, based at Evère, near Brussels.
Training Centre, at Coxyde.
Officer's School, at Tirlemont.
Maintenance School, at Saffraenberg.

For the above force about 5,000 men will be mobilised. The Defence Budget for 1946 included a sum of 278,000,000 francs for the future Air Force, of which 160,000,000 francs was ear-marked for personnel and 118,000,000 francs for aircraft and maintenance.

BOLIVIA

(The Bolivian Republic—República de Bolivia)

NATIONAL MARKINGS



RUDDER FUSELAGE & WINGS

THE BOLIVIAN AIR FORCE

The Bolivian Air Force, which used to be part of the Army, was organized as a separate service at the end of 1944. It is controlled by the Minister of Defence, through a Chief of Staff who is an Air Force officer of Colonel's rank.

ORGANIZATION

Ministerio de Defensa Nacional, La Paz.
Minister of National Defence : Colonel Jorge Jordan.
Direccion-General de Aeronautica, La Paz.

The Bolivian Air Force is divided among four Regiones Aéreas with headquarters at La Paz, Santa Cruz, Sucre and Tarija. There are four aviation groups, one to each area, and each comprising one or two squadrons (escuadrillas) of seven aircraft each.

Región Aérea No. 1, "El Alto," La Paz.
Región Aérea No. 2, "El Trompillo," Santa Cruz.
Región Aérea No. 3, "La Florida," Sucre.
Región Aérea No. 4, "El Tejar," Tarija.
Escuela de Pilotaje (Flying Training School), "Colcapirua," Cochabamba.
Escuela de Application (Operational Training Unit), "El Alto," La Paz.

EQUIPMENT

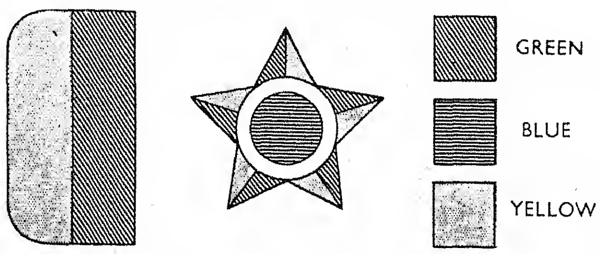
Fighting :—Curtiss Hawk, Curtiss CW-22.
Training :—Curtiss R-19, North American AT-6A, Beechcraft AT-17 and AT-11, Vultee BT-13 Valiant, Ryan PT-16, Boeing PT-17, Stinson Voyager, Interstate L-8.
Transport :—Douglas C-47 Dakota, Junkers Ju 86.
Miscellaneous :—Grumman OA-9, Curtiss Osprey, Focke Wulf.

During the war Bolivia received a small number of aircraft under Lend-Lease from the United States.

BRAZIL

(The United States of Brazil—Estados Unidos do Brasil)

NATIONAL MARKINGS



RUDDER WINGS ONLY

THE BRAZILIAN AIR FORCE

By Presidential Decree dated January 20, 1941, an Air Ministry was created to co-ordinate all branches of aeronautics within the Republic. The administration and units of the former Army and Naval Air Services have been transferred from the Ministries of War and Marine to the new Ministry and the new independent Air Force has been given the name Forças Aereas Brasileiras (F.A.B.).

ORGANIZATION

The Air Ministry (Ministeria do Ar), Rio de Janeiro.
Air Minister : Major-General Armando Trompowski de Almeida.

The organization of the Air Ministry includes :—

The Air Staff (Estado Major da Aeronautica)
Chief of the Air Staff : Major Brigadier Gervasio Duncan de Lima Rodriguez.

Responsible for training, war plans and tactical use of the Air Force and the anti-aircraft defences, either independently or in collaboration with the General Staffs of the Army, the Navy or the Civil Defence authorities.

There are also Departments responsible for **Personnel, Training, Research and Technical Development, Material, Works and Buildings, Anti-Aircraft Defence, Commercial Air Services** and **Civil Flying.**

AIR ZONE COMMANDS.

No. 1 Air Zone. Headquarters : Belém.
Officer Commanding : Brigadier Altair E. Rozsanyi.

Covers the States of Amazones, Pará, Maranhão, and Acre Territory.

BRAZIL—*continued.*

No. 2 Air Zone. Headquarters: Recife.
Officer Commanding: Brigadier A. Vieira Mascarenhas.
Covers the States of Piauí, Ceará, Rio Grande de Norte, Paraíba, Pernambuco, Alagôas, Sergipe, and Bahía.

No. 3 Air Zone. Headquarters: Rio de Janeiro.
Officer Commanding: Brigadier Fabio de Sá Earp.
Covers the States of Espirito Santo, Rio de Janeiro, Minas Geraes, Goiás and the Federal District.
Under this command are the Central Air Park, the Air Technical Services, the Central Aeronautical Stores and the Air Medical Centre, all based at the Campo dos Alfonsos Air Base, Rio de Janeiro; and the Aircraft Factory, Central Aeronautical Stores, Air Medical Centre and Flying Training Unit attached to the School of Technical Training at the Ponto do Galeão Marine Air Base, on the Ilha do Governador, Buenos Aires.

No. 4 Air Zone. Headquarters: São Paulo.
Officer Commanding: Brigadier Armando de S. e E. Ararigboia.
Covers the States of São Paulo and Matto Grosso.

No. 5 Air Zone. Headquarters: Porto Alegre.
Officer Commanding: Major-Brigadier Fernando V. de A. Savaget.
Covers the States of Paraná, Santa Catarina and Rio Grande do Sul.

TRAINING ESTABLISHMENTS

Escola de Aeronautica (Air Force College), Campo dos Alfonsos, Rio de Janeiro.

Established in 1941 in the buildings formerly occupied by the Escola de Aviação Militar at the Campo dos Alfonsos, Rio de Janeiro. This establishment trains officers for both the Military and Naval wings. The training course lasts three years.

Escola de Especialistas de Aeronautica (School of Technical Training), Ponto do Galeão.
This establishment has taken over the former separate training schools of the Army and Naval Air Services. It trains all engineer officers and mechanics.

Escola Tecnica de Aviacão (Technical School of Aviation), São Paulo.

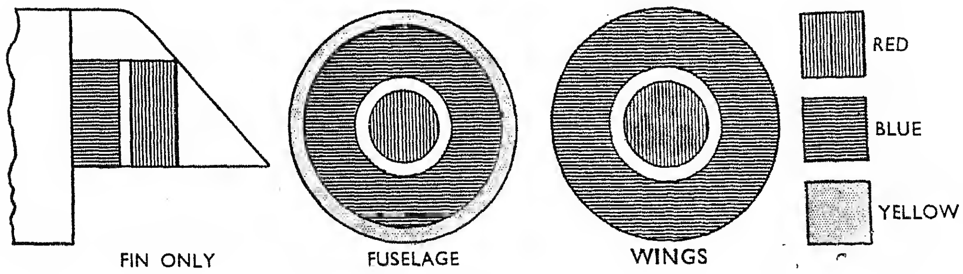
Established in 1943 for the training of technicians and specialists for the Air Force and airlines.

EQUIPMENT

Fighting:—Curtiss P-40, Republic P-47.
Bombing:—North American NA-44, Douglas B-18, North American Mitchell, Consolidated Catalina, Lockheed Hudson.
Training:—Avro 626, Muniz M-9, Focke-Wulf Fw 44J and Fw 58B, Stearman 75L3 and 76 C3, Waco F-5, D.H. Moth, Vultee 54 Valiant, Fairchild M-62.
Transport and Miscellaneous:—Douglas Dakota, Bellanca Pacemaker, Lockheed 12 and 14, Beechcraft D-17A and Waco C-8.
The United States provided Brazil with 2,500 fighter, bomber, trainer and transport aircraft under Lend-Lease during the war. Brazilian officers and men were trained by American instructors at air bases both in the United States and Brazil.

THE BRITISH COMMONWEALTH OF NATIONS

1—THE BRITISH EMPIRE



GREAT BRITAIN AND NORTHERN IRELAND

THE ROYAL AIR FORCE

The Royal Air Force was formed on April 1, 1918, by the amalgamation of the Royal Flying Corps and the Royal Naval Air Service. The basic organization of the Royal Air Force begins at the Air Ministry. The controlling authority of the Air Ministry is the Air Council, which is charged by Parliament with the administration of matters relating to the Air Force and the defence of the Realm by air. The President of the Air Council is the Secretary of State for Air and the four Air Members of the Council and the Permanent Under Secretary of State are constituted as the five departmental heads among whom the main duties of the Air Ministry are divided.
Marshal of the Royal Air Force: H.M. King George VI.

THE AIR COUNCIL

The Rt. Hon. Philip Noel-Baker, P.C., M.P., Secretary of State for Air (President).
Mr. Geoffrey de Freitas, M.P., Parliamentary Under-Secretary of State for Air (Vice-President).
Marshal of the Royal Air Force The Lord Tedder, G.C.B., Chief of the Air Staff.
Air Marshal Sir William F. Dickson, K.B.E., C.B., D.S.O., A.F.C., Vice-Chief of the Air Staff.
Air Marshal Sir John C. Slessor, K.C.B., D.S.O., M.C., Air Member for Personnel.
Air Marshal Sir Leslie N. Hollinghurst, K.B.E., C.B., D.F.C., Air Member for Supply and Organization.
Air Marshal Sir Roderick M. Hill, K.C.B., M.C., A.F.C., A.D.C., Air Member for Technical Services.
Air Vice-Marshal Sir W. Alec Coryton, K.B.E., C.B., M.V.O., D.F.C., Controller of Supplies (Air), Ministry of Supply.
Sir James Barnes, K.B.E., Permanent Under-Secretary of State for Air.
Lord Henderson, Additional Member.

R.A.F. HOME COMMANDS

Bomber Command. Headquarters: High Wycombe, Bucks.
Air Officer Commanding-in-Chief: Air Marshal Sir Hugh W. L. Saunders, K.B.E., C.B., M.C., D.F.C., M.M.
Fighter Command. Headquarters: Bentley Priory, Stanmore, Middlesex.
Air Officer Commanding-in-Chief: Air Marshal Sir James Robb, K.B.E., C.B., D.S.O., D.F.C., A.F.C.
British Air Forces of Occupation (Germany).
Air Officer Commanding-in-Chief: Air Marshal Sir Horace E. P. Wigglesworth, K.B.E., C.B., D.S.C.
Coastal Command. Headquarters: Northwood, Middlesex.
Air Officer Commanding-in-Chief: Air Marshal Sir Leonard Slatter, K.B.E., C.B., D.S.C., D.F.C.
Coastal Command also administers:—
R.A.F. in Northern Ireland. Headquarters: Belfast, N. Ireland.
Air Officer Commanding: Air Commodore A. R. Churchman, D.F.C.
Royal Air Force, Gibraltar.
Air Officer Commanding: Air Commodore A. D. Rogers, C.B.E., A.F.C.
Flying Training Command. Headquarters: Shinfield Park, Reading, Berks.
Air Officer Commanding-in-Chief: Air Marshal Sir Arthur Coningham, K.C.B., K.B.E., D.S.O., M.C., D.F.C., A.F.C.
Maintenance Command. Headquarters: Amport, Andover, Hants.
Air Officer Commanding-in-Chief: Air Marshal C. B. Cooke, C.B., C.B.E.
Technical Training Command. Headquarters: Brampton Grange, Huntingdon.

BRITISH COMMONWEALTH—GREAT BRITAIN—*continued.*

Air Officer Commanding-in-Chief: Air Marshal Sir Ralph Sorley, K.C.B., O.B.E., D.S.C., D.F.C.

Transport Command. Headquarters: Bushey Park, Teddington, Middlesex.
Air Marshal The Hon. Sir Ralph Cochrane, K.B.E., C.B., A.F.C.

Reserve Command. Headquarters: R.A.F. Station, White Waltham, near Maidenhead, Berks.
Air Officer Commanding-in-Chief: Air Vice-Marshal Sir Alan Lees, K.C.B., C.B.E., D.S.O., A.F.C.

Reserve Command administers the R.A.F. Volunteer Reserve, the Auxiliary Air Force, the Air Training Corps and the University Air Squadrons.

Reserve Command includes the following Groups:—
- No. 61 (Eastern Reserve) Group, Headquarters: R.A.F. Station, Kenley, Surrey.
- No. 62 (Southern Reserve) Group, Headquarters: R.A.F. Station, Middle Wallop, Stockbridge, Hants.
- No. 63 (Western and Welsh Reserve) Group, Headquarters: R.A.F. Station, Hawarden, Chester.
- No. 64 (Northern Reserve) Group, Headquarters: R.A.F. Station, Norton, Sheffield.
- No. 65 (London Reserve) Group, Headquarters: R.A.F. Station, Hendon, N.W.8.
- No. 66 (Scottish Reserve) Group, Headquarters: R.A.F. Station, Turnhouse, Edinburgh, 12.

R.A.F. OVERSEAS COMMANDS

Royal Air Force, Mediterranean and Middle East.
Headquarters: Canal Zone, Egypt.
Air Commander-in-Chief: Air Marshal Sir Charles E. H. Medhurst, K.C.B., O.B.E., M.C.

This Command represents the merging of the former Mediterranean and Middle East Command (formerly located at Naples) and H.Q., R.A.F. Middle East. It embraces all R.A.F. activities in the Central Mediterranean, North Africa and the Middle East Area, including the Levant and Iraq, Aden and East Africa. Air H.Q., Italy, and Air H.Q., Austria, under the same Command, supervise R.A.F. units still remaining with the occupation forces in Italy and Austria respectively.

This Command includes:—

Headquarters, R.A.F. Austria. Address: Klagenfurt, Austria.
Air Officer Commanding: Air Commodore R. H. S. Spaight.

Air Headquarters, R.A.F. Italy. Address: Caserta, Italy.
Air Officer Commanding: Air Vice-Marshal L. Darvall, C.B., M.C.

Air Headquarters, Greece. Address: Athens, Greece.
Air Officer Commanding: Air Commodore G. W. Tuttle, C.B., O.B.E., D.F.C.

Air Headquarters, Malta. Address: Valetta, Malta.
Air Officer Commanding: Air Vice-Marshal K. B. Lloyd, C.B.E., A.F.C.

Air Headquarters, East Africa. Address: Nairobi, Kenya Colony.
Air Officer Commanding: Air Commodore S. H. C. Gray, O.B.E.

Air Headquarters, Levant. Address: Jerusalem, Palestine.
Air Officer Commanding: Air Commodore H. D. McGregor, C.B.E., D.S.O.

Air Headquarters, Iraq. Address: Habbaniyah, Iraq.
Air Officer Commanding: Air Vice-Marshal A. Gray.

H.Q. British Forces, Aden. Address: Steamer Point, Aden.
Air Officer Commanding: Air Vice-Marshal H. T. Lydford, C.B.E., A.F.C.

Air Command, South-East Asia.
Headquarters: Singapore.
Air Commander-in-Chief: Air Chief Marshal Sir George C. Pirie, K.C.B., M.C., D.F.C.

This Command includes:—

Air Headquarters, Burma. Address: Rangoon, Burma.
Air Officer Commanding: Air Vice-Marshal A. C. Sanderson, C.B.E., D.F.C.

Air Headquarters, Ceylon. Address: Kandy, Ceylon.
Air Officer Commanding: Air Commodore C. E. Chilton, C.B.E.

Air Headquarters, Malaya. Address: Kuala Lumpur, Malay States.
Air Officer Commanding: Air Vice-Marshal J. D. Breakey, C.B., D.F.C.

Headquarters, R.A.F. Hong Kong. Address: Hong Kong, China.
Air Officer Commanding: Air Commodore S. N. Webster, C.B.E., A.F.C.

No. 232 Group, Singapore.
Air Officer Commanding: Air Cdre. A. Earle, C.B.E.

Air Headquarters, West Africa. Address: Accra, Gold Coast.
Air Officer Commanding: Group Captain R. K. Hamblin, C.B.E.

Royal Air Force, India.
Headquarters: New Delhi, India.
Air Commander-in-Chief: Air Vice-Marshal Sir Hugh S. P. Walmsley, C.B., C.B.E., M.C., D.F.C.

THE AUXILIARY AIR FORCE

The twenty Auxiliary Air Force squadrons which were merged with the Royal Air Force at the outbreak of War in September, 1939, are being re-formed as auxiliary units.

The squadrons will, as before the war, recruit personnel locally under the direction of the County Territorial Army and Air Force Associations. At the outset all members recruited must be ex-members of the Royal Air Force and will serve for a period of five years if commissioned and four years if non-commissioned. About half the flying personnel of each squadron will be commissioned.

Pilots and navigators will be required to complete each year 15 days' continuous training, 100 hours non-continuous training in evenings and at week-ends, this training to include a total of 125 hours flying. Airmen will be required to do 15 days' continuous training and 30 hours non-continuous training in evenings and at week-ends.

Each squadron will be a fully-equipped first-line fighting unit. Their equipment will include Supermarine Spitfires (thirteen day fighter squadrons) and de Havilland Mosquitos (three night-fighter squadrons and four light bomber squadrons).

The Squadrons will be stationed as under:—
- No. 500 (County of Kent), West Malling, Kent.
- No. 501 (County of Gloucester), Filton, Bristol.
- No. 502 (Ulster), Aldergrove, N. Ireland.
- No. 504 (County of Nottingham), Hucknall, Notts.
- No. 600 (City of London), Biggin Hill, Surrey.
- No. 601 (County of London), Hendon, Middlesex.
- No. 602 (City of Glasgow), Abbotsinch, Paisley.
- No. 603 (City of Edinburgh), Turnhouse, Edinburgh.
- No. 604 (County of Middlesex), Hendon, Middlesex.
- No. 605 (County of Warwick), Honniley, Coventry.
- No. 607 (County of Durham), Ouston, Durham.
- No. 608 (North Riding), Thornaby, Yorks.
- No. 609 (West Riding), Church Fenton, Yorks.
- No. 610 (County of Chester), Hooton Park, Liverpool.
- No. 611 (West Lancashire), Woodvale.
- No. 612 (County of Aberdeen), Dyce, Aberdeen.
- No. 613 (East Lancashire), Ringway, Manchester.
- No. 614 (County of Glamorgan), Llandow, Glam.
- No. 615 (County of Surrey), Biggin Hill, Surrey.
- No. 616 (South Yorkshire), Finningley, Yorks.

THE UNIVERSITY AIR SQUADRONS

The University Air Squadrons are administered by Reserve Command. Members are required to put in a minimum of 20 hours' flying training a year in term time and 15 days' continuous training at an R.A.F. station during vacation. The University Air Squadrons and their stations are as under:—
- Aberdeen University Air Squadron, Dyce.
- Birmingham University Air Squadron, Castle Bromwich.
- Cambridge University Air Squadron, Cambridge.
- Durham University Air Squadron, Ouston.
- Edinburgh University Air Squadron, Turnhouse.
- Glasgow University Air Squadron, Abbotsinch.
- Leeds University Air Squadron, Church Fenton.
- London University Air Squadron, Biggin Hill.
- Manchester University Air Squadron, Barton.
- Nottingham University Air Squadron, Newton.
- Oxford University Air Squadron, Shellington.
- Queen's (Belfast) University Air Squadron, Aldergrove.
- St. Andrews University Air Squadron, Leuchars.
- Southampton University College Air Squadron, Worthy Down.

THE R.A.F. REGIMENT

Commandant: Major-General A. E. Robinson, D.S.O.

The R.A.F. Regiment, which was created in February, 1942, remains an integral part of the Royal Air Force. It maintains Rifle, Armoured and Light Anti-Aircraft squadrons for service at home and overseas, and other personnel are trained as airborne and parachute troops. Some personnel will do tours as air-gunners.

The R.A.F. station personnel, both at home and overseas, continue to be the R.A.F.'s main ground defence force, and one of the Regiment's most important tasks is the combat training of all ranks of the R.A.F. by providing courses at the Regimental Depot for officers and N.C.O.'s of the Air Force, and the provision of Regimental instructors on stations.

Other responsibilities of the Regiment are the provision of weapon and field training instructors at Recruit Centres, and the provision of officers and N.C.O.'s required for native levies maintained by the R.A.F. overseas.

Cadets of the R.A.F. Regiment will undergo their training at the Royal Military Academy, Sandhurst.

THE WOMEN'S AUXILIARY AIR FORCE

Commandant-in-Chief: H.M. The Queen.
Director: Air Commandant F. H. Hanbury, M.B.E.

The Women's Auxiliary Air Force was formed on June 28, 1939, by Royal Air Force Companies of the A.T.S., which had been formed in 1938. In general the W.A.A.F. follows the lines of the Women's Royal Air Force which was formed in the 1914-18 War and was disbanded in 1919.

The W.A.A.F. is an integral part and comes under the direct command of the Royal Air Force, its chief object being to

BRITISH COMMONWEALTH—GREAT BRITAIN—*continued.*

permit where possible the substitution of women for R.A.F. personnel in various appointments and trades, thus releasing the men for other duties.

Pending the establishment of a permanent post-war W.A.A.F., which will be recruited on a voluntary basis, provision is being made for women to continue in the service on short-term engagements with a view to their joining the regular force when this is introduced. Provision is also being made for a reserve for part-time services on the lines of the R.A.F. Volunteer Reserve.

THE AIR TRAINING CORPS

Air Commodore-in-Chief: H.M. the King.

Commandant: Air Vice-Marshal Sir Alan Lees, K.C.B., C.B.E., D.S.O., A.F.C. (Air Officer Commanding-in-Chief, Reserve Command).

With the approval of H.M. the King, the Air Training Corps came into being on February 1, 1941. Its formation was in reality achieved by the Air Ministry taking over the Air Defence Cadet Corps which had been formed in 1938 by the Air League of the British Empire. The Corps is now administered by R.A.F. Reserve Command.

The Air Training Corps exists primarily to give boys who wish to join the Royal Air Force or Naval Aviation such training as will fit them for aircrew duties or for certain duties on the ground. Enrolment is open to boys of 15 to 18 years of age who are physically fit.

There are 84 A.T.C. gliding schools in the United Kingdom, and during 1946 nearly 3,000 cadets completed gliding courses. Gliding courses last for about eight week-ends and over 700 voluntary instructors give up their spare time to teach the cadets.

At the end of 1946 the strength of the Corps was approximately 57,000 cadets in about 1,100 units. The normal post-war strength has been established at 75,000.

THE ROYAL OBSERVER CORPS

Commandant: Air Cdre. the Earl of Bandon, C.B., D.S.O., R.A.F.

The Royal Observer Corps, which received permission from His Majesty the King to assume its "Royal" title in April, 1941, is a civil volunteer force which is administered by the Air Ministry and is controlled operationally by Fighter Command. Its function in war is to detect and keep continuous track of every hostile aircraft flying over the British Isles by day or by night.

The Corps was in operation twenty-four hours a day from September, 1939, until the end of hostilities, and, at its peak, consisted of 32,000 full-time and part-time Observers (both men and women) at over a thousand posts throughout the country.

On May 1, 1945, the stand-down of the Corps was announced, but after eighteen months it has been re-formed on a peace-time basis, and was scheduled to be completely re-organised by January 1, 1947. The new organisation provides for a nucleus of permanent officers, and a total of 28,500 part-time volunteer Observers, the latter drawn initially only from Observers with war-time experience in the Corps. A regular training programme, including practice plotting, aircraft recognition and occasional co-operation exercises with the Royal Air Force will be provided.

NAVAL AVIATION

Control of naval aircraft and shore stations was transferred from the Royal Air Force to the Admiralty in 1939. In 1946 the names Fleet Air Arm and Naval Air Arm were superseded by the general term Naval Aviation.

As the result of experience gained during the War, Naval Aviation (at home) is organized as follows:—

Fifth Sea Lord (Air)
Vice-Admiral Sir Philip L. Vian, K.C.B., K.B.E., D.S.O.

Flag Officer (Air) (Home)
Rear Admiral Sir Thomas Troubridge, K.C.B., D.S.O.

Flag Officer Flying Training
(Rear Admiral L. D. Mackintosh, C.B., D.S.O., D.S.C.)
- Air Stations
- Trials Carrier

Rear Admiral Reserve Aircraft
(Rear Admiral (E) J. L. Bedale, C.B.)
- Reserve Aircraft
- Air Stations

Air Stations

Trials Carrier
(H.M.S. *Illustrious*)

Naval Aviation afloat is controlled by the various Commands, the second-in-command of which is usually a Vice-Admiral (Air).

At the time of writing no details of the future composition and strength of Naval Aviation had been made available for publication but it will be eventually approximately one-third of the strength of the Royal Navy.

Owing to the difficult manning situation caused by extensive demobolisation since the end of the war, the aircraft-carrier force of the Royal Navy has had to be drastically reduced. Of the six ships of the Fleet Carrier Class (23,000 tons) commissioned during the war, the *Implacable* was at the end of 1946 serving temporarily with the Home Fleet; the *Illustrious* was acting as Trials Carrier; the *Indefatigable* and *Indomitable* were laid up in reserve; and the *Victorious* and *Formidable*, employed temporarily on trooping duties, were to be laid up early in 1947. The only other ships in commission were six of the Light Fleet Carriers of the "Colossus" and "Majestic" Classes (14,000 tons).

A new scheme has been approved for the manning of naval aircraft. The majority of pilots will be ratings, the remainder being General Service Royal Navy and Royal Marine officers trained for the dual purpose of pilot and observer. Rating pilots will be mainly recruited from civil life. A small proportion will be recruited from Aircraft Artificers and Royal Marines for temporary flying service, and a few ratings from other branches will be allowed to transfer to rating pilots. Only continuous service rating pilots and those "hostilities only" rating pilots accepted for an extended service engagement will be transferred to the new scale of pilot rates.

All regular Sub-Lieutenants of the Royal Navy are now being taught to fly as part of their general syllabus. The R.N. Air Training Course lasts about six weeks and is intended to provide every naval officer with an introduction to practical flying and to evaluate the suitability of all regular officers for flying duties should they volunteer for service in Naval Aviation.

SOUTHERN RHODESIA

In 1936 the Government of Southern Rhodesia formed the nucleus of an Air Section of the Permanent Staff Corps and six recruits were sent to Great Britain for a course of technical training with the Royal Air Force. In the following year two R.A.F. officers were seconded for duty with the Air Section. On the outbreak of War in September, 1939, the Government offered to bring the air unit up to the strength of a full squadron, to man two more squadrons and maintain them in the field with the R.A.F. on any front. This offer was accepted by the British Government and the first Rhodesian Squadron was despatched to serve with the R.A.F., Middle East Command.

Rhodesia had two squadrons operating on the Western Front, and both played a full part in all R.A.F. operations preceeding and during the liberation of Europe. The third Rhodesian squadron served with the First Tactical Air Force throughout the Italian campaign and covered the Allied landings in Southern France in August, 1944. This squadron, formerly No. I (Rhodesia) Squadron, was the first Dominion squadron in the field when the War broke out. It was at its station at Nairobi two days before the outbreak of the War on Sept. 3, 1939.

Southern Rhodesia's greatest contribution to the War was its training organization. The Southern Rhodesian Air Training Group was the first to open an Elementary Flying Training School under the British Commonwealth Air Training Plan—in May, 1940. The Group was also the first to turn out trained pilots and the first to complete its scheme.

The original scheme was greatly expanded and men from the United Kingdom, African Colonies and Territories, the Belgian Congo, Australia, and from the Middle East and Allied Nations were trained in Rhodesia.

Southern Rhodesia continues to serve as a training ground for the Royal Air Force. An agreement has been reached between the British and Southern Rhodesian Governments whereby two flying Schools will be established, one at Heany, near Bulawayo, and the other at Thornhill, near Givelo, with wing headquarters at Kumalo, on January 1, 1947.

Training, initial, basic and advanced, will be spread over 18 months, and when fully developed the schools will have an annual output of over 300 trained pilots and navigators. Operational training will be completed in the United Kingdom.

The R.A.F. will provide the aircraft and 1,766 personnel required for administrative, training and maintenance duties.

BRITISH COMMONWEALTH—SOUTHERN RHODESIA—*continued.*

Southern Rhodesia, which will provide a further 972 personnel required for various other duties, will share in the training facilities offered and should, as the scheme develops, be in a position to provide some of the instructors and fill a number of the administrative posts.

The Officer Commanding, Southern Rhodesian Forces, is Air Vice-Marshal C. W. Meredith, C.B., C.B.E., A.F.C., who commanded the Southern Rhodesian Air Training Group during the war. The Senior Air Staff Officer is Group Capt. E. W. S. Jacklin, A.F.C.

INDIA

THE ROYAL INDIAN AIR FORCE

The Indian Air Force was constituted with effect from October 8, 1932, by the Governor-General in Council in pursuance of the Indian Air Force Act, 1932. The first flight of No. 1 Squadron of the Indian Air Force was formed on April 1, 1933. In March 1945, His Majesty the King approved the designation "Royal Indian Air Force." The Royal Indian Air Force is administered by the Defence Department of the Indian Government.

The Indian Government has announced that it is their intention to maintain the R.I.A.F. at an initial peacetime strength of ten squadrons, plus the necessary training and other ancilliary units required to provide a fully balanced force. It is emphasised that this is only an initial minimum strength which will be expanded as rapidly as conditions permit and as personnel becomes available.

As a first step towards meeting anticipated requirements of regular officers for the R.I.A.F., the Government of India decided, before the war with Japan was over, to grant a number of Government commissions to Indian officers serving in the Air Force. At the time this decision was made the number of such commissions to be granted was determined at ninety.

In order to provide additional officers for the R.I.A.F. units which will be formed to replace the R.A.F. units which are to be withdrawn from India as nationalisation progresses, two new categories of commissions are being introduced. These are the Extended Service Commission, and the Short Service Commission. All wartime Emergency Commissioned Officers (other than those selected for Permanent Commissions and those of the Administrative and Special Duties Branch, except ex-regular airmen), will be invited to apply for Extended Service Commissions. The extended service will be for four years on the active list and four on the reserve. Officers who accept extended service will be eligible for appointment to permanent commissions during their active list time.

2—THE SELF-GOVERNING DOMINIONS

THE DOMINION OF CANADA

THE ROYAL CANADIAN AIR FORCE

The Royal Canadian Air Force is administered by the Department of National Defence, Canada, through the Minister of National Defence, who is advised by an Air Council consisting of the following members :—

THE AIR COUNCIL

The Hon. Brooke Claxton, M.P., Minister of Defence. (President of the Air Council).

H. F. Gordon, Deputy Minister of Defence. (Vice-President of the Air Council).

Air Marshal Robert Leckie, C.B., D.S.O., D.S.C., D.F.C., Chief of the Air Staff.

Air Vice-Marshal W. A. Curtis, C.B.E., D.S.C., E.D., Air Member for Air Staff.

Air Vice-Marshal H. L. Campbell, C.B.E., Air Member for Personnel.

Air Vice-Marshal C. R. Slemon, C.B., C.B.E., Air Member for Supply and Organisation.

Air Vice-Marshal A. L. James, C.B.E., Air Member for Research and Development.

Special Appointments.

Director of Construction and Engineering: Air Cdre. J. G. Bryans, O.B.E.

Director of Equipment and Supply: Air Cdre. R. A. London, O.B.E.

Director of Accounts and Finance: Air Cdre. J. M. Murray, C.B.E.

Director of Organization and Appointments: Air Cdre. A. C. Gordon, C.B.E.

Commandant, R.C.A.F. Staff College: Air Cdre. A. D. Ross, G.C., O.B.E.

Chairman, Officers' Selection Board: Air Cdre. W. A. Orr, O.B.E.

ADMINISTRATION

Administration of the Force is exercised by R.C.A.F. Headquarters, Ottawa, through five Commands—three Operational and two Air Commands, as follow :—

OPERATIONAL COMMANDS

Eastern Air Command, Halifax, Nova Scotia.

Air Officer Commanding-in-Chief: Air Vice-Marshal A. L. Morfee, C.B.E.

Western Air Command, Vancouver, British Columbia.

Air Officer Commanding: Air Vice-Marshal J. L. Plant, C.B.E.

North Western Air Command, Edmonton, Alberta.

Air Officer Commanding: Air Vice-Marshal T. A. Lawrence, C.B.

AIR COMMANDS

No. 1 Air Command, Trenton, Ontario.

Air Officer Commanding: Air Vice-Marshal E. E. Middleton, C.B.E.

No. 2 Air Command, Winnipeg, Manitoba.

Air Officer Commanding: Air Vice-Marshal K. M. Guthrie, C.B.E.

The Air Officer Commanding-in-Chief, R.C.A.F. Overseas (with headquarters in the United Kingdom) is Air Marshal G. O. Johnson, C.B., M.C.

NON-OPERATIONAL COMMANDS

Maintenance Command.

Air Officer Commanding: Air Vice-Marshal R. E. MacBurney, C.B.E.

No. 9 Group (Training).

Air Officer Commanding: Air Cdre. L. E. Wray, O.B.E., A.F.C.

ORGANIZATION

The Minister of National Defence has announced that the peace-time strength of the R.C.A.F. is to be established at approximately 30,600 of all ranks. It will comprise a regular force of 16,100 capable of rapid expansion, an air auxiliary force of 4,500, and a reserve of 10,000 consisting almost entirely of officers and airmen who served during the War and have since returned to civil life.

It is proposed that the present five Commands will be reduced to two, to be based at Trenton, Ont. and Edmonton, Alta. The Commands at Halifax, Winnepeg and Vancouver are being reduced to Group headquarters. The regular Air Force will be made up of eight operational squadrons.

Plans for an Auxiliary Air Force, now to be incorporated in the organization of the R.C.A.F. for the first time, provide for an ultimate maximum of fifteen squadrons to be located at the main centres of population throughout the Dominion.

NAVAL AVIATION

Director of Canadian Naval Aviation: Capt. R. E. S. Bidwell, C.B.E., R.C.N.

Deputy Director: Capt. G. A. Rotheram, D.S.O., O.B.E., R.N.

The Canadian Navy is retaining an Air Section in its post-war organization. Two light carriers are being transferred to the Royal Canadian Navy and four Royal Navy squadrons were, some time ago, allocated for manning by R.C.N. personnel for ultimate transference to the Royal Canadian Navy for service in these carriers.

The first carrier, H.M.C.S. *Warrior*, was commissioned in March, 1946 and Nos. 803 and 825 Squadrons were transferred to R.C.N. control to serve as the *Warrior's* Air Group. The two other squadrons earmarked for transfer (Nos. 826 and 883) have been temporarily disbanded in the United Kingdom, but will reform as R.C.N. squadrons when the second carrier H.M.C.S. *Magnificent*, is commissioned.

THE COMMONWEALTH OF AUSTRALIA

THE ROYAL AUSTRALIAN AIR FORCE

The Australian Air Force was formed by Proclamation on March 31, 1921, pending the passage of the Air Defence Act. On August 13, 1921, it became the Royal Australian Air Force. The Air Defence Act received Royal Assent on September 1, 1923, under which the Royal Australian Air Force became a separate service of the defence forces of the Commonwealth, with equal status to the Royal Australian Navy and the Commonwealth Military Forces.

BRITISH COMMONWEALTH—AUSTRALIA—*continued.*

THE AIR BOARD

The Air Board is responsible for the administration, training, equipment and maintenance of the R.A.A.F., as well as for works and buildings.

The constitution of the Air Board is as follows :—

The Hon. A. S. Drakeford, M.P., Minister of State for Air.

Air Marshal G. Jones, C.B., C.B.E., D.F.C., Chief of the Air Staff.

Air Vice-Marshal J. E. Hewitt, O.B.E., Air Member for Personnel.

Air Vice-Marshal E. C. Wackett, O.B.E., Air Member for Engineering and Maintenance.

Air Vice-Marshal G. J. W. Mackinolty, O.B.E., Air Member for Supply and Equipment.

H. C. Elvins, Esq., Finance Member.

R. H. Nesbitt, Esq., Business Member.

F. J. Mulrooney, Esq., Secretary.

M. C. Langslow, Esq., M.B.E. The Secretary, Department of Air, is an ex-officio member of the Board, as is P. E. Coleman, Esq., O.B.E., The Assistant Secretary, Department of Air.

ORGANIZATION

The Royal Australian Air Force is divided into the following administrative areas.

Northern Area.

Air Officer Commanding: Group Capt. A. D. Charlton.

Controls all operations in Queensland, Northern Territories, New Guinea and adjacent Islands.

Eastern Area.

Air Officor Commanding: Air Cdre. A. M. Charlesworth, A.F.C.

Controls operations in New South Wales.

Southern Area.

Air Officer Commanding: Air Cdre. E. G. Knox-Knight, O.B.E.

Controls operations in Victoria, South Australia, Western Australia and Tasmania, and also administers all training.

The organization and establishment of the post-war Royal Australian Air Force has not yet been laid down, but the Chief of the Air Staff has announced that such a force will comprise three types of squadrons ; long-range heavy bomber, fighter and transport. In the meantime the establishment of an interim force of 15,000 has been approved by the Commonwealth Government. This force will maintain an Air Transport Service between Australia and Japan, and will also make up part of the British Commonwealth Occupation Forces. In addition general survey and experimental work will be carried out.

An immediate programme of aircraft production has been drawn up and investigations are proceeding concerning the production of guided projectiles. Until such time as a decision has been arrived at with regard to the strength and composition of the post-war R.A.A.F., the Australian Aircraft Industry is fulfilling the following military production programme :—73 Lincoln heavy bombers and 12 Tudor II transports (Beaufort Division) ; 209 Mosquitos and 50 Vampires (de Havilland Aircraft Co., Pty., Ltd.) ; 250 Mustangs (Commonwealth Aircraft Corporation). The Rolls-Royce Merlin and Nene engines required for this programme are also in production in Australia.

R.A.A.F. OVERSEAS

Overseas Headquarters, Royal Australian Air Force: Kodak House, Kingsway, London, W.C.2.

Air Officer Commanding: Air Cdre. V. E. Ewart.

Overseas Headquarters, R.A.A.F., has taken over the duties formerly undertaken by the Air Liaison Office, London, which ceased to function on November 30, 1941.

The High Commissioner remains the representative of the Commonwealth Government in the United Kingdom and deals with all matters of Government policy. Otherwise Overseas Headquarters is the channel of communication between the Department of Air, Melbourne, and the Air Ministry, London.

British Commonwealth Occupational Forces, Japan.

Air Officer Commanding: Air Vice-Marshal F. M. Bladin, C.B.E., R.A.A.F.

TRAINING

Director of Training: Group Capt. J. A. Cohen, D.F.C.

For administrative purposes all training comes within the Southern Area.

THE DOMINION OF NEW ZEALAND

THE ROYAL NEW ZEALAND AIR FORCE

The Royal New Zealand Air Force was constituted a separate branch of the Defence Forces of the Dominion by the Air Force Act of 1937. Its control is vested in an Air Board, with the Minister of Defence, who is also in charge of the Air Department, as its President.

THE AIR BOARD

The Hon. F. Jones, M.P., Minister of Defence (President).

Air Vice-Marshal A. de T. Neville, C.B., C.Sc., A.F.R.Ae.S., Chief of the Air Staff and Air Officer Commanding the Royal New Zealand Air Force.

Group Capt. M. F. Calder, Air Member for Personnel.

Air Cdre. S. Wallingford, C.B.E., Air Member for Supply.

Mr. T. A. Barrow, J.P., Air Secretary.

ORGANIZATION

The establishment of five permanent Air Force squadrons with their necessary organizations has been recommended in a report on the post-war R.N.Z.A.F. which has been drawn up by the Chief of the Air Staff. The recommendation provides for an establishment of approximately 420 officers and 3,000 airmen. The annual cost of the organization would be in the vicinity of £2,000,000 and there would be no items of capital expenditure during the first few years.

The recommendations call for the maintenance of three squadrons, one medium bomber, one fighter-bomber and one transport— within the Dominion and two squadrons—one medium bomber and one flying-boat in the Islands area, with headquarters at Nandi (Fiji Islands) and Lauthala Bay (Fiji Islands) respectively.

In addition there is provision for a Territorial Air Force consisting of a Fighter Wing, a Bomber Wing and a Technical Wing, and an Air Training Corps of four Wings.

American aircraft used by the R.N.Z.A.F. during the war are being replaced by British aircraft, the first stage of re-equipment being the acquisition of ninety D.H. Mosquitos.

In February, 1946, training was re-opened to provide ground personnel for the post-war Air Force.

R.N.Z.A.F. transport squadrons are operating passenger and freight services on a combined military and commercial basis to island possessions, mandated territories and British islands in the South Pacific, including Fiji, Tonga, Samoa, Rarotenga, and will continue to do so until the recently-formed National Airways Corporation can take over the services.

UNION OF SOUTH AFRICA

(Unie van Suid Afrika)

THE SOUTH AFRICAN AIR FORCE

The South African Air Force is a branch of the South African Permanent Force and is administered by the Minister of Defence.

At the beginning of the War the Force consisted of one squadron and a total of 1,500 men. By the end of the war the South African Air Force had a total of 34 active squadrons including heavy, medium and fighter-bombers, fighters and photographic reconnaissance units.

ORGANIZATION

Chief of the Union Defence Forces Staff: General Sir Pierre van Ryneveld, K.B.E., C.B., D.S.O., M.C.

Air Force Headquarters: Roberts Heights, Pretoria.

Director-General of the S.A.A.F.: Brigadier H. G. Willmott, C.B.E.

Deputy Director-General of the S.A.A.F.: Colonel J. T. Durrant, C.B., D.F.C.

The post-war organization and establishment of the South African Air Force had not been announced up to the time of closing down for press. The interim equipment of the S.A.A.F. consists of the Supermarine Spitfire (fighter) ; Lockheed-Vega Ventura (medium bomber and coastal reconnaissance) ; Short Sunderland (oversea reconnaissance) and Douglas Dakota (transport).

EIRE

THE IRISH AIR CORPS

Military Aviation organized in the Irish Air Corps is a component of the Defence Forces and is controlled by the Department of Defence (Roinn Cosanta), Parkgate, Dublin.

The Headquarters of the Air Corps is at Baldonnel Aerodrome, Co. Dublin. The Officer Commanding the Air Corps, is Colonel W. P. Delamere.

ORGANIZATION

Baldonnel is the principal centre of military aviation and accommodates the Depot Air Corps, The Flying Training School, the Co-operation Unit, the Maintenance Unit, and the Boy Apprentices' Training School.

The Service Unit is stationed at the only other aerodrome maintained in operation, namely Gormanston, Co. Meath, where the Air Firing Ranges are situated.

BRITISH COMMONWEALTH—EIRE—*continued.*

PERSONNEL

All Officer personnel hold regular commissions. Every alternate year selected personnel are drawn from the Military Cadet College for training as pilots. Engineer Officers are taken on a direct entry from the Universities.

The bulk of the pilot personnel is supplied by an N.C.O. Pilot Scheme, by which there is an intake every alternate year. Technical personnel are supplied through the medium of direct entry or on an Apprentice Training Scheme.

TRAINING

The primary purpose of the Air Corps is to train and maintain Fighter Units.

The Co-Operation Unit is responsible for general flying, including :—Reconnaissance, Photography, Target Towing, Crew Training and Communications.

Plans for training on a volunteer basis are under consideration.

EQUIPMENT

Elementary Training :—Miles Magister, of which a number of reconditioned aircraft was purchased in 1946.

Intermediate Training :—Miles Master II.

Advanced Training :—Hawker Hurricane II.

Co-operation Flight :—Avro Anson, Avro XIX, Miles Martinet.

Service Unit :—Supermarine Spitfire V.

All repair and overhaul work is undertaken by the Maintenance Unit.

CHILE

(The Chilean Republic—República de Chile)

NATIONAL MARKINGS

THE CHILEAN AIR FORCE

The Chilean Air Force, or Fuerza Aerea de Chile, was formed as an autonomous fighting service, including Army and Naval Aviation, under the Ministry of Defence in 1930. The Commander-in-Chief of the Air Force is directly responsible to the Ministry of Defence for the discipline, administration, training and general instruction of the Air Force. An Under-Secretariat of Aviation exists to provide the necessary Liaison between the Air Force and the Ministry of Defence.

ORGANIZATION

Cuartel-General de la Fuerza Aerea, Ministerio de Defenca Nacional. Plaza Bulnes, Santiago.

Commander-in-Chief of the Fuerza Aerea : Air-General Manual Tovarias Arroyo.

The Commander-in-Chief has at his disposal an Air Council composed of the following :—The Commander-in-Chief, Chief of the General Staff, Director of Services, Director of Personnel and Director of Aeronautics.

HEADS OF DEPARTMENTS OF THE CHILEAN AIR FORCE.

Commander-in-Chief : Air General Manuel Tovarias Arroyo.

Chief of General Staff : Air Brigade General Edison Diaz Salvo.

Director of Services : Air Brigade General Raul Gonzalez Nolle.

Director of Training Establishments : Air Brigade General Oscar Herreros Walker.

Director of Aeronautics : Group-Captain Gregorio Bisquert Rubio.

Staff Director : Group-Captain Armando Rivera Fuentes.

Commander of Anti-Aircraft Defence and Director of Construction : Air Brigade General Osvaldo Puccio Guzman.

Director of Accounts : Air Brigade General Roberto Rotger Wylie.

THE CHILEAN AIR FORCE

The Air Force consists of four Air Brigades as follows :—

Ia. Air Brigade (Antofagasta) composed of :—
Aviation Group No. 1. (Iquique).
Aviation Group No. 7 (Antofagasta).

IIa. Air Brigade (El Bosque) composed of :—
Aviation Group No. 2 (Quintero).
Aviation Group No. 4 (Colina).

IIIa. Air Brigade (Temuco) composed of :—
Aviation Group No. 3 (Temuco).
Aviation Group No. 5 (Puerto Montt).

IVa. Air Brigade (Punta Arenas) composed of :—
Aviation Group No. 6 (Punta Arenas).
Aviation Group No. 8 (Puerto Natales).

The Services Department is responsible for the supply, distribution and maintainance of the air equipment required, and has the two following Supplementary Departments working with it :—
Central Aviation Supply.
Central Aviation Arsenal.

The principal Air Base is El Bosque (15 km. south of Santiago), where the "Capitan Avalos" Training School is situated, specialising in the instruction of air pilots. Trainees for the School are recruited from the civil population and at the end of three years obtain their degrees as Pilot and Officers. The cadets then take a course at the Fighter and Bomber School, before being posted to particular Units. This latter School is temporarily attached to Aviation Group No. I, Iquique. Other establishments based at El Bosque are the Technical School, the Anti-aircraft School and the Central Aviation Arsenal.

EQUIPMENT

Primary Training :—Fairchild PT-19 and Stearman N3N.

Advanced Training :—Vultee BT-13, North American N.A. 44 and AT-6.

Naval Reconnaissance :—Vought Sikorsky OS2U-3, Consolidated PBY-5 Catalina.

Bombing : Douglas A-24.

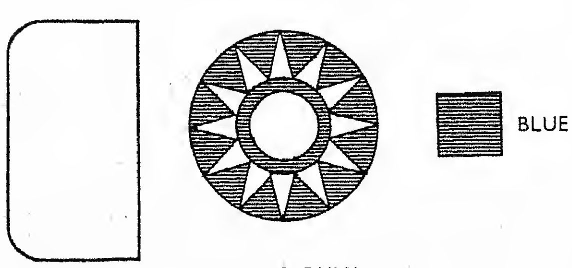
Transport :—Beechcraft C-45F.

During the war Chile received approximately one hundred fighter trainer and naval patrol aircraft from the United States, under Lend-Lease.

CHINA

(The Great Chinese Republic—Chang-Hua Min-Kuo)

NATIONAL MARKINGS



Control of the Armed Forces in China is vested in the National Military Council, of which General Chiang Kai-Shek is the head. The Chinese Air Force is controlled by a Commission of Aeronautical Affairs, with headquarters at Nanking. The Officer Commanding the Chinese Air Force is General C. J. Chow.

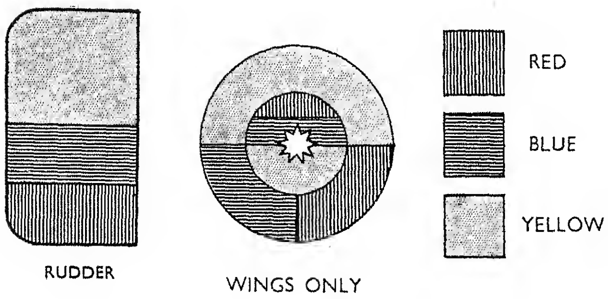
The Chinese Air Force, never very large, suffered heavily at the hands of the Japanese. Organization, according to Western standards, is poor but efforts have been made to reorganize and re-equip the Air Force with British and American assistance.

The American authorities have given training assistance to the Chinese Air Force. Large numbers of Chinese pupils have received instruction in Army Air Force schools in the United States and assistance was also given by American personnel in China in operational training, repair, and maintenance. A licence for the manufacture of the Boeing Kaydet trainer has been acquired by the Chinese authorities.

COLOMBIA

The Republic of Colombia—Repùblica de Colombia)

NATIONAL MARKINGS



THE COLOMBIAN AIR FORCE

As an outcome of re-organization in 1943, the Colombian Air Force (Fuerza Aerea Colombiana) is now a separate air arm under the control of the Ministry of War.

ORGANIZATION

Ministerio de Guerra, Direccion-General de Aviacion, Bogota.

Director-General of Aviation: Lieut-Col. Luis F. Pinto.

The Colombian Air Force consists of fighting, reconnaissance and training units, details of which are not available.

The Military Aviation School is situated at Cali.

EQUIPMENT

Fighting :—Curtiss Hawk, Republic Thunderbolt.
Reconnaissance :—Curtiss Falcon.
Bombing :—Boeing Fortress (3), North American Mitchell (3).
Training :—Fairchild, North American AT-6.
Miscellaneous and Transport :—Sikorsky amphibian, Curtiss Condor, Junkers W 33, W 34, K43 and Ju 52, Ford Trimotor and Consolidated P2Y.

CUBA

(The Republic of Cuba—Republica de Cuba)

NATIONAL MARKINGS

THE CUBAN AVIATION CORPS

The Cuban Aviation Corps, or Cuerpo de Aviacion, is administered by an aviation section of the Secretariat of National Defence. It is a small service using modern aircraft of American origin. It has naval and military branches.

ORGANIZATION

Secretaria de Defensa Nacional, Departamento de Direccion, Seccion de Aviacion, Havana.

Aviacion de Ejercito (Military Aviation): H.Q., Ciudad Militar, Havana.

Officer Commanding: Lieut.-Col. Camilo G. Chavez.

Aviacion Naval (Naval Aviation): H.Q., Marina de Suerra, Havana.

Officer Commanding: Captain de Corbeta Ernesto J. Usatorres Ubieta, M.N.

TRAINING

Escuela del Cuerpo de Aviacion, Campo de Colombia, Havana.

This establishment has a capacity for 75 cadets. It is provided with laboratories, workshops, radio and meteorological office.

EQUIPMENT

Training :—Stearman A73-B1, Aeronca.
Advanced Training :—Waco, Curtiss-Wright 19-R, North American AT-6.
Transport :—Bellanca, Howard DGA-15.
Amphibian :—Grumman G-21.

CZECHOSLOVAKIA

(The Czechoslovak Republic—Ceskoslovenska Republika)

During the war the Czechoslovak Air Force was grouped within the framework of the Royal Air Force, its own Inspectorate being established at the Air Ministry to be responsible for the administration of all Czechoslovak Air Force units and Czechoslovak personnel serving in the United Kingdom.

The first Czechoslovak fighter and bomber squadrons to be formed in England became operational in August and September, 1940, respectively. Subsequently two further fighter squadrons were formed and after June, 1942, the three fighter squadrons operated as an independent Czechoslovak Fighter Wing. In April, 1942, the bomber squadron was transferred to Coastal Command, with which it served until the end of the war. Czechoslovak pilots also served with various R.A.F. units, including both day and night fighter squadrons, Transport Command squadrons, and as instructors at various schools.

In June, 1944, a Czechoslovak Air Regiment was formed in Russia and this unit took part in the fighting in eastern Czechoslovakia, operating from aerodromes on Czechoslovak territory.

On August 16, 1945, the four squadrons which served with distinction in the United Kingdom with the R.A.F., Nos. 310, 312 and 313 fighter squadrons equipped with Spitfires and No. 311 general-reconnaissance squadron equipped with Liberators, returned to Prague after six years of war, and these units form part of the new Czechoslovak Air Force which is now being re-organized.

DENMARK

(The Kingdom of Denmark—Kongeriget Denmark)

Immediately after the capitulation of the German forces in Denmark on May 5, 1945, the cadres of the Army Air Force (Haerens Flyvertropper) and Navy Air Force (Marinens Flyvevaesen) were re-formed. As Denmark was congested with German prisoners of war and refugees and was under the control of the British disarmament authorities no airfields or air stations were, however, available for use for several months. The principal fields are the former Danish airfields at Vaerloese (army), Kastrup and Aalborg W (civil) and the former naval air stations at Copenhagen (seaplane base) and Avnoe (land aerodrome). These had all been enlarged and improved by the *Luftwaffe*, which had also built many other airfields, suitable for modern aircraft, the chief of which are Aalborg E, Karup, Tirstrup, Vandel and Skrydstrup in Jutland and Beldringe on the island of Funen. A seaplane base had also been built at Aalborg. Even after the airfields and air stations had been evacuated and released the Danish air forces were virtually inactive owing to complete lack of aircraft and an acute shortage of trained personnel after several years of enforced demobilization.

In the Summer of 1945, the Danish Minister of Defence appointed Lieut. Col. K. Birksted, D.S.O., D.F.C., a former Danish flying officer, who had served with distinction in the R.A.F. and the Royal Norwegian Air Force during the war, as an adviser on the reconstruction of the Danish air forces. Later in the same year an Air Committee, comprising Lieut. Col. Birksted, the Head of the Army Air Force, Colonel T. P. A. Oerum, and the Head of the Navy Air Force, Captain P. Scheibel, R.D.N., was set up to further the reconstruction with a view to the introduction of a unified Danish Air Force, which is likely to succeed the present divided organization.

During the Winter and Spring of 1945-46 the majority of the remaining experienced pilots of the Army and Navy Air Forces received refresher courses and conversion training to modern fighter aircraft with the R.A.F. in the United Kingdom. During the same period a number of technical personnel were trained in England, and a small number of Percival Proctor III aircraft were bought for communication purposes. In the Spring of 1946 basic training of a number of army and naval officers was

DENMARK—*continued.*

begun at the Naval Elementary Flying Training School at Avnoe, equipped with Danish-built K.Z. II trainers.

In accordance with the decision of the Ministry of Defence (War Office and Admiralty) it is planned to establish a Technical Training School (at Vaerloese), Advanced Flying Training Schools (Harvards and Oxfords) and an Operational Training Unit (Spitfire IXs). Two flights of flying-boats (Catalina and Sea Otter amphibians) will be organized for air/sea-rescue and communications purposes at home and overseas (Greenland). The necessary equipment will largely be bought from British surplus material, which was expected to begin to arrive in Denmark in the latter part of 1946.

The above-mentioned scheme will be carried out by using Army and Navy air force personnel, as well as equipment and facilities, on a common basis, with the Air Committee acting as a co-ordinating body until an actual unified Air Force is organized.

DOMINICAN REPUBLIC

(Santo Domingo—Republica Dominicana)

An Aviation Company forms part of the National Army. This Company, commanded by Major Fernando M. Castillo, is under the direction and supervision of the Secretary for War and Marine, who is also Commander-in-Chief of the National Army, and is based at the General Andrews Airport, Ciudad Trujillo. There the Company has established schools for the training of both pilots and technicians.

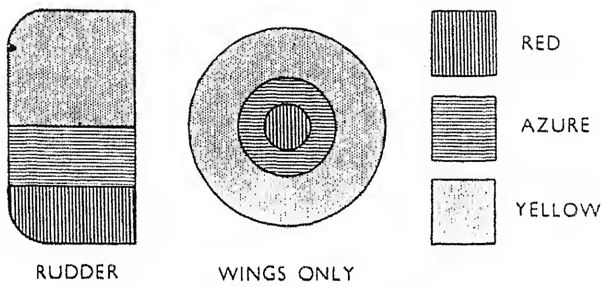
The equipment of the company consists of the following types of aircraft :—

Primary Training :—Boeing PT-17.
Intermediate Training :—Consolidated-Vultee BT-13.
Advanced Training :—North American AT-6A, Curtiss R-19.
Artillery Liaison :—Aeronca L-3.

ECUADOR

(The Republic of El Ecuador—República del Ecuador)

NATIONAL MARKINGS



THE EQUADORIAN AIR FORCE

The Air Force of Ecuador is part of the Army and is administered by a Commandant of Military Aviation who is responsible through the Superior Army Command to the Minister of Defence, Colonel Carlos Mancheno C.

By an agreement between the Ecuadorian and American Governments facilities were placed at the disposal of the latter for the establishment of an air base at Punta Salinas for the defence of the Canal Zone. The School of Aviation has been transferred from Quito to Punta Salinas, where the U.S. Air mission is based.

ORGANIZATION

The organization of the Ecuadorean Air Force, or Fuerza Aerea Ecuatoriana, is composed of the following :—

Comandancia de Aeronautica, Quito.
Commandant of the Air Force : Lieut.-Col. Bayardo Tobar A.
Air Base Commands.
Group Commands.
School of Aviation, Guayaquil (Primary) and Punta Salinas (Advanced).
Aerial Bases and smaller airports.

TRAINING

Commissioned flying personnel is recruited from different branches of the Army, from the Military Cadet College, from non-commissioned personnel (with a degree) or university students and from students of secondary schools.

Specialist personnel complete their training with special courses after joining their units.

EQUIPMENT

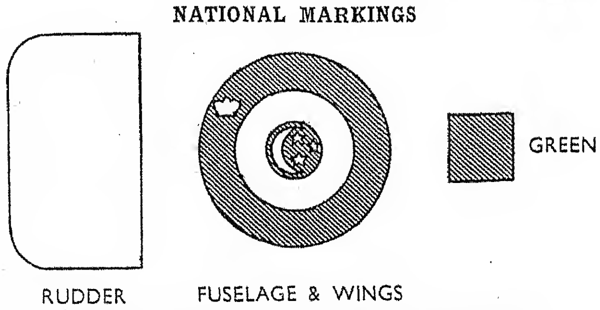
Fighting:—Republic P-35.
Transport:—Junkers Ju 52, Bellanca.
Training:—North American NA-16, Curtiss-Wright R-19, Curtiss-Wright 16E, Fairchild M-62, Ryan PT-20.

During the war Ecuador received forty-seven aircraft from the United States under Lend-Lease.

EGYPT

(The Kingdom of Egypt—Misr)

NATIONAL MARKINGS



THE ROYAL EGYPTIAN AIR FORCE

The Royal Egyptain Air Force was formed in 1932, when six D.H. Moths, bought in England, were flown to Egypt by British trained Egyptian officers. Until 1937 the Egyptian Air Force was commanded and trained by British officers.

ADMINISTRATION

The Command and administration of the Air Force is under the Director, Royal Egyptian Air Force, Lewa (Major-General) M. Metwalli Pasha, who is directly responsible to the Minister of National Defence.

ORGANIZATION.

The Headquarters of the Royal Egyptian Air Force is at present located in Cairo. The Air Force is composed mainly of three stations, near Cairo, Alexandria and Helwan. Squadrons are mainly equipped with fighters, fighter-bombers and transport aircraft.

TRAINING.

The R.E.A.F. now undertakes all training in its own schools and instruction is done solely by Egyptian instructors. The following are the principal training establishments :—

Flying Training School.
Consists of one Elementary, one Intermediate and one Advanced training squadron. Aircraft used for training are the Miles Magister for primary and the Harvard for intermediate and advanced training. Students are chosen from Military College graduates and qualify as Pilot Officers in the period of one year of training.

Technical Training Schools.
These are schools for Technical Training, Signals and Electrical, Armament, Air Photography, Safety Equipment and Stores.

All mechanics and specialist recruits are chosen from volunteers who have passed their primary education. During a course of two years they specialise as riggers, fitters, W/T operators, etc. In addition, the R.E.A.F. employs a large number of skilled civilians in the workshops.

School of Air Support.
This School was formed in 1945. Students are chosen from the Army and Air Force. The period of training is six weeks.

FINLAND

(The Finnish Republic—Suomen Tasavalta)

Under the terms of the Draft Peace Treaty drawn up by the Allied Powers, Finland will be allowed to maintain an Air Force made up of sixty aircraft and a personnel strength of 3,000 officers and other ranks. Finland will be forbidden to maintain a bomber force and will not be permitted to engage in experiments with or the construction of remote-controlled piloted or pilot-less aerial weapons.

FRANCE

(The French Republic—République Française)

THE ARMEE DE L'AIR

The Air Force of France (*Armée de l'Air*) is, with the exception of the Naval Air Arm afloat and some shore-based naval units, under the control of the Minister for Air, who has the advice of a Civil Council, a Military Council and a Special Air Staff. In peace and war the *Armée de l'Air* is under the supremo command of the Chief of the Air Staff.

ORGANIZATION.

The *Armée de l'Air* comprises (*a*) a territorial organization based on the division of Metropolitan France into Aerial Regions (Régions Aériennes) and overseas territories into Air Commands (Commandements de l'Air); (*b*) Air defence forces, transport and liaison units and police and security squadrons; (*c*) schools and training establishments; (*d*) anti-aircraft defenses; and (*e*) miscellaneous services.

TERRITORIAL ORGANIZATION.

Metropolitan France is divided into four Aerial Regions:—
1ère Région Aérienne. H.Q.: Dijon.
2eme Région Aérienne. H.Q.: Paris.
3eme Région Aérienne. H.Q.: Bordeaux.
4eme Région Aérienne. H.Q.: Aix-en-Provence.

Each region includes Staff, units, depot, establishments, medical service, liaison units, etc., and one or more centres of military instruction.

North Africa includes:—
One **Région Aérienne (5eme).** H.Q.: Algiers.
One **Commandement de l'Air** in Algeria.
One **Commandement de l'Air** in Morocco.
One **Commandement de l'Air** in Tunisia.

Each Command disposes similar elements to those of the Région Aérienne.

Territories of the Union Française include :—
One **Commandement de l'Air** in A.O.F. (West Africa).
One **Commandement de l'Air** in A.E.F. (Equatoral Africa).
One **Commandement de l'Air** in A.Or.F. (Madagascar, etc.).
One **Commandement de l'Air** in Indo China.
One **Commandement de l'Air** in Somaliland.

Each Command disposes, according to its importance, of some of the elements composing a Région Aérienne.

AIR INTERCEPTOR FORCES.

The Air Interceptor Forces comprise an Aerial Division (Division Aérienne) and a number of elements not incorporated in divisions.

1ère Division Aérienne. Composed of fighter and reconnaissance wings (escadres), anti-aircraft defenses and ground establishments.

The non-divisional elements comprise:—
Metropolitan France. Fighter Groups and Heavy Bomber Wings.
North Africa. Fighter Wings and a Mixed Wing (consisting of fighter-bomber and reconnaissance groups).
Indo-China. One Fighter Wing.

Air Transport units are disposed as follows:—
Metropolitan France. One Air Command, several Transport Wings and an instructional school for transport aircrews.
North Africa. One Transport Wing.
A.O.F. (West Africa). One Transport Group.
Indo-China. Sectors and Groups.

Police and security units include air squadrons in A.O.F. (West Africa) and A.E.F. (Equatorial Africa).

TRAINING.

The training organization includes the following:—
Metropolitan France. Training Command; cadet schools; primary and advanced flying training schools; school for navigators, gunners and bombardiers; school for W/O navigators; instructor's school and specialist's schools.
North Africa. Advanced flying training schools (fighting and twin-engined conversion) and signals schools (tele-communications).

NAVAL AVIATION

French Naval Aviation is administered by the Ministry of Marine and is manned by naval personnel. Certain units for operational purposes come under the control of the Armée de l'Air.

RE-EQUIPMENT.

A comprehensive scheme of British assistance in the reconstruction of the *Armée de l'Air* and the Naval Air Arm is now being fulfilled as the result of two agreements between the British and French Governments.

Under one agreement, the British Government undertakes to supply to the *Armée de l'Air*:—

(*a*) Aircraft and equipment for units of the *Armée de l'Air* in Metropolitan France, French North Africa, French Equatorial Africa and Indo-China, including three year's maintenance requirements.
(*b*) Aircraft and equipment for training schools in France and North Africa, including three years maintenance requirements.
(*c*) Complete radio, radar and signals equipment, including eleven mobile radar stations and four complete radio schools, and again including three year's maintenance requirements.
(*d*) R.A.F. schools and instructors to train French personnel in the use of British equipment.
(*e*) Repair equipment issued by the Ministry of Aircraft Production for the use of the French aircraft repair organization, and:—
(*f*) Facilities and technical assistance in the manufacture under licence in French factories of British aircraft, engines and spare parts, airscrews and equipment.

Initially, 1,287 aircraft were handed over to the *Armée de l'Air* by the R.A.F. These include 242 Spitfires, 238 Mosquitos, 64 Halifax bombers, 141 Ansons and 185 Wellingtons.

The British Government has also undertaken to supply the Naval Air Arm with the following on favourable terms:—

(*a*) Aircraft and equipment for one carrier-based fighter squadron, including replacement aircraft, and maintenance equipment.
(*b*) Two naval air centres with full equipment, ships, lorries and enough spares to provide for three year's upkeep.
(*c*) One Air/Sea Rescue centre, with eight high-speed launches, 24 spare engines and spare equipment for three year's upkeep.
(*d*) Aircraft, marine craft and equipment for other units of the Naval Air Arm.
(*e*) Radio and radar equipment for French-built aircraft, for ground training and for ground stations.
(*f*) Training in the United Kingdom for personnel of the Naval Air Arm.

Aircraft handed over to the Naval Air Arm include 48 Seafires, 13 Sunderlands, 32 Wellingtons and 65 trainers.

Britain has also lent France for five years the aircraft-carrier *Collosus* (now renamed *Arromanche*), which has accommodation for 40 aircraft. This augments the light escort-carrier *Dixmude*, (formerly H.M.S. *Biter*) which was handed over to France in 1943.

GREECE

(The Kingdom of Greece—Hellas)

At the outbreak of the Greco-Italian War in November, 1940, the Royal Hellenic Air Force was suffering some initial disadvantage from its size and from the lack of an individual tradition. The fact that its senior officers were recruited from the Army and the Navy, although advantageous to co-operation, did not assist the formation of this tradition.

The shortage of equipment placed certain marked limitations upon the tactical employment of the Royal Hellenic Air Force but a strategical reinforcement by fighter squadrons of the Royal Air Force was provided, and the combined force remained in action until the Allied withdrawal from Greece on April 23, 1941.

After that date a number of Royal Hellenic Air Force personnel and some aircraft succeeded in reaching Egypt and from these, implemented from other sources, the nucleus of a new Royal Hellenic Air Force came into being.

It was organized along the lines of the Royal Air Force, which gave every assistance and established a liaison organization through which the Greeks could become familiar not only with the administration and operation of the R.A.F. but with the best means and methods whereby their own problems could be solved and progress facilitated.

The first operational unit of the Royal Hellenic Air Force went into service early in 1942 equipped with Hawker

GREECE—*continued.*

Hurricane single-seat fighters. All pilots, both officers and N.C.O.s, had previously been engaged on flying duties either on the Albanian front against the Italians or during the German invasion which followed. This squadron was initially engaged in shipping protection, both by day and by night, in the Mediterranean, and it later took part in the Italian campaign. It was later equipped with the Supermarine Spitfire.

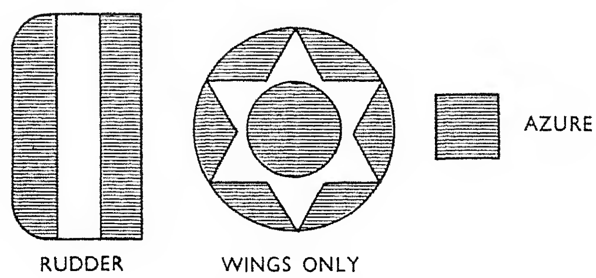
A Hellenic bomber squadron also served as a mixed unit as, although all pilots and navigators were Greek, insufficient trained personnel made it necessary for R.A.F. air-gunners and some ground staff to be employed. This squadron joined the R.A.F. Balkan Air Force on its formation in 1944, and took part in operations in Yugoslavia until the end of hostilities in Europe. Originally equipped with the Bristol Blenheim, it was later armed with the Martin Baltimore.

No details concerning the post-war organization of the Royal Hellenic Air Force have yet been made available for publication.

GUATEMALA

(The Republic of Guatemala—República del Guatemala)

NATIONAL MARKINGS



The Air Force of Guatemala, or Cuerpo de Aeronautica Militar, is under the administration of the Army Command. It has recently been modernised, the system of training has been brought up-to-date and it now possesses 38 aircraft of American make, mainly trainers.

ORGANIZATION

Aeronautica Militar, Secretaria de Guerra, Guatemala City.
Chief of Military Aviation and Director-General of Civil Aviation: Colonel Rodolfo Mendoza A.
Escuela de Aeronautica Militar, "La Aurora" Airport, Guatemala City.

EQUIPMENT.

Fighting :—Boeing P-26.
Training :—Caudran, Boeing PT-17, Ryan, Waco, Vultee BT-15 and North American AT-6.

HONDURAS

(Republic of Honduras—República de Honduras)

NATIONAL MARKINGS

Military Aviation in Honduras is administered by the Department of War, Marine and Aviation.

ORGANIZATION

Departamento de Guerra, Marina y Aviacion, Tegucigalpa.
Minister of War, Navy and Aviation: Dr. Juan Manual Galvez.
Director of Military Aviation: Lieut.-Col. H. A. White.
Assistant-Director: Capt. L. A. Fiallos.

The Director of Military Aviation also controls all Civil Aviation in the Republic.

The Honduras Military Air Arm is a small force equipped with about 40 American aircraft. The Military Aviation School is situated at Tegucigalpa, the capital. North American NA-16, Waco and Ryan ST trainers are used.

HUNGARY

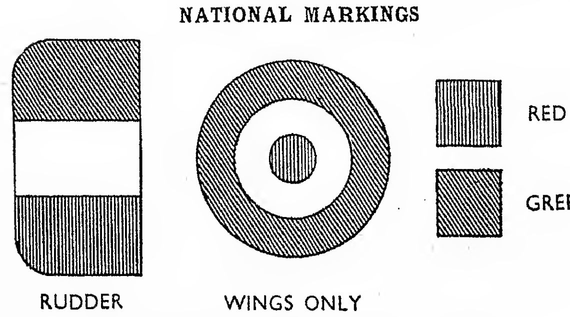
(The Kingdom of Hungary—Magyarorszag)

Under the draft Peace terms Hungary will be permitted to maintain an Air Force comprising 90 aircraft (70 combat types) and a personnel strength of 5,000 officers and other ranks. It will be forbidden to maintain any bombing aircraft, nor to engage in experiments with or the construction of remote-controlled piloted or pilot-less aerial weapons.

IRAN (PERSIA)

(The Kingdom of Iran—Mamalik-i-mahrousseh-i-iran)

NATIONAL MARKINGS



THE ROYAL IRANIAN AIR FORCE

The Air Force of Iran, which was created in 1924, is an integral part of the Army. It is administered by the Aviation Department of the Ministry of War and is subordinated to the General Staff of the Army. The Commander of the Air Force and Head of the Aviation Department is usually a high officer of the General Staff with the rank of Brigadier or above. There is, however, a permanent Inspector-General of the Air Force, who is Major-General Ahmad Nakhtchevan. The headquarters of the Air Force is at Teheran.

ORGANIZATION

The Air Force is made up of two Regiments, one Bomber and one Reconnaissance. Both the Regiments are stationed at Teheran (Doshan Teppeh). The Reconnaissance Regiment has three detachments disposed at Ahwaz, Kermanshah and Isfahan.

TRAINING

Up to 1932 all pilots for the Iranian Air Force were trained abroad, either in France or Soviet Russia. In 1932 a Flying Training School was established at Mehrabad and, with the exception of twelve officers who were sent to Great Britain in 1935, all pilots have since been trained in Iran.

The Flying Training School at Doshan Teppeh, consists of three Groups, Elementary, Service and Advanced. There is also one Ground Training Group. The majority of the F.T.S. pupils are officers, but N.C.O.'s are also trained.

EQUIPMENT

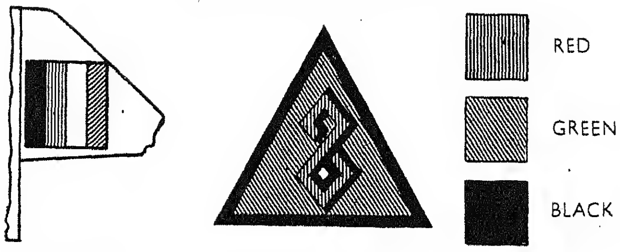
Fighting :—Hawker Hurricane.
Reconnaissance :—Hawker Hind, Hawker Audax.
Bombing :—Avro Anson.
Training :—D.H. Tiger Moth, Hawker Hurricane (two-seat).

The Maintenance and Repair Unit located at Teheran (Doshan Teppeh), where major repairs and overhauls are undertaken, was leased to the R.A.F. between 1942 and 1945, but was returned to the Iranian Air Force after that date.

'IRAQ

(The Kingdom of 'Iraq—Mesopotamia)

NATIONAL MARKINGS



FIN ONLY FUSELAGE & WINGS

THE ROYAL IRAQI AIR FORCE

The Royal 'Iraqi Air Force was formed in 1931. The first few officer pilots were trained in England at the R.A.F. College at Cranwell, but a Training School of the R.I.A.F. was opened in Baghdad in June, 1933. The instructors were Royal Air Force and 'Iraqi officers who had passed through the R.A.F. Central Flying School. Originally the mechanics of the R.I.A.F. were trained at the R.A.F. Depôt at Hinaidi but later an Apprentices' Training School, modelled on R.A.F. lines and employing R.A.F. instructors, was instituted within the R.I.A.F.

The Royal 'Iraqi Air Force is a part of the Army and comes under the direction of the Ministry of Defence. The command and administration of the Air Force is under an officer known as the Officer Commanding, Royal 'Iraqi Air Force, who is directly responsible to the Chief of the General Staff. The system of internal administration and command is similar to corresponding formations in the British Royal Air Force.

ORGANIZATION

The Royal 'Iraqi Air Force consists of the following units :—

No. 1 (Army Co-operation) Squadron, Mosul.
No. 4 (Fighter) Squadron, Kirkuk.
No. 5 (Fighter) Squadron, Al Rashid, Baghdad.
No. 7 (Fighter-Bomber) Squadron, Al Rashid, Baghdad.
Communications Flight, Al Rashid, Baghdad.
Flying Training School, Al Rashid, Baghdad.

The Commanding Officer, 'Aqid (Colonel) Semi Fattah, is reorganizing the Air Force with the co-operation of R.A.F. officers and N.C.O's, who are now employed in the Royal 'Iraqi Air Force and form part of the British Military Mission to the 'Iraqi Army.

In October, 1943, cadets were sent to England for training, and a number of 'Iraqi pilots have been sent to R.A.F. Middle East establishments for advanced flying training. Aircraft have been obtained from R.A.F. sources and from the British Aircraft Industry. An order has been placed with Hawker Aircraft, Ltd. for a series of Fury single-seat Fighters.

ITALY

(The Republic of Italy—Republica d'Italia)

Under the draft Peace Terms drawn up by the Allied powers, Italy will be permitted to maintain an Air Force made up of 200 fighter and reconnaissance aircraft and 150 transport and other miscellaneous types. Bomber aircraft will be forbidden. The permitted strength of the Air Force will be 25,000 officers and other ranks. Italy will not be allowed to conduct experiments with or engage in the construction of remotely-controlled piloted or pilot-less aerial weapons. Italy has been allowed to purchase from U.S. disposal stocks 100 Lockheed P-38 single-seat fighters, and it also possesses a number of other types of Allied aircraft which were made available during the period of co-belligerency. Small orders have been placed with the Italian aircraft Industry for new aircraft.

JAPAN

(The Japanese Empire—Nippon)

In 1946 the Japanese Diet drew up a new constitution for Japan, of which the outstanding clause announced that "War, as a sovereign right of the nation, and the threat or use of force, is for ever renounced as a means of dealing with other nations. The maintenance of land, sea and air forces, as well as other war potential, will never be authorised. The right of belligerence of the State will not be recognised."

The terms of the new constitution, which will abolish all national armed forces, has received the official approval of the Allied Commander of the occupation forces in Japan.

MEXICO

(The United States of Mexico—Estados Unidos Mexicanos)

Military Aviation in Mexico is administered by the Direccion de Aeronautica, a branch of the Ministry of National Defence. A naval air service is in course of being built up.

ORGANIZATION

Ministerio de Guerra y Marina, Mexico City.

President of the Republic and Minister for National Defence :— General Manuel Avila Camacho.

Direccion de Aeronautica Militar.

Address : Calzada Mexico-Puebla, Mexico, D.F.

Director of Military Aviation : General Gustavo Salinas Camina.

The Mexican Air Force, or Fuerza Aerea Mexicana, has its headquarters at the Valbuena Air Base, Mexico City.

The Military Flying School is situated at Guadalajara and is under the direction of the Direccion-General de Educacion Militar but the directors and staff are supplied by the Air Force. Cadet pilots receive their primary training at Guadalajara and after completion of both primary and basic training in Mexico proceed to other schools for advanced training.

The ground staff forms the Corps of Aeronautical Mechanics, the technical personnel of which are trained at Valbuena.

The Direccion de Aeronautica is responsible for the administration of the Talleres Nacionales de Construcciones Aeronauticas, or National Aircraft Factory, Valbuena, which is equipped to build complete aircraft. It also undertakes all overhaul and repair of military aircraft.

EQUIPMENT

Fighting :—Republic P-47 Thunderbolt.
Training :—Ryan ST, North American AT-6, Vultee BT-13 and BT-15, Fairchild PT-19, Fleet Finch (Canadian-built), Tezuitlan (Mexican-built).
Reconnaissance :—Vought O2U-1 Corsair, Vought-Sikorsky OS2U-1 Kingfisher, North American AT-6 (with armament).
Light Bomber :—Douglas A-24 Dauntless and A-20 Havoc.
Transport :—Lockheed Lodestar, Beechcraft C-45.

THE NETHERLANDS

(The Kingdom of the Netherlands—Nederland)

THE NETHERLANDS AIR FORCE

Directorate of Netherlands Air Forces (Directoraat de Luchtstrijdkrachten).

Headquarters : 63, Gevers Deynootweg, Scheviningen.

Service Aviation in the Netherlands is organized in three separate arms :—the Naval Air Service, the Army Air Force and the Army Air Force of the Netherlands East Indies Army.

As only a few air-crews were able to escape from Holland during the war, the Dutch Government had little flying personnel at its disposal and consequently this separation could not always be maintained. Thus it was necessary to attach the greater part of the Army flying personnel to the Naval Air Service, with the result that during a particular period a large percentage of the strength of No. 320 (Dutch) Squadron operating with the Royal Air Force, which originally was a Naval Squadron, consisted of Army personnel.

This centralisation was carried a stage further when in 1944 it was decided to create the Directorate of Netherland Air Forces (Directoraat der Luchtstrijdkrachten), which had a co-ordinating task and formed the link between the Naval and Army Air Forces. This Directorate was responsible for recruiting immediately after the liberation, 50% of this recruited and trained personnel being placed at the disposal of the Naval Air Service, while the other 50% was destined for the Army. The Marine and War Department contributed equally in the expenses of this training programme.

NETHERLANDS—*continued.*

The first plans, based on the continuance of the War in the Far East, had to be adapted to peace-time establishments upon the unexpected sudden termination of hostilities. At first, unforeseen difficulties were experienced regarding equipment and the fitting out of stations. In the meantime an elaborate training and material procurement programme was set up, with as its aim the formation of a joint training organization, necessary for the reconstruction of the Naval Air Service and Army Air Forces. The Royal Netherlands Navy is no longer training any personnel on its own account. All training is being done in co-operation with the Army Air Force under the Directorate of Netherlands Air Forces.

Owing to a lack of facilities and equipment in the Netherlands after five years of enemy occupation, recruits of the Netherlands Air Forces are being trained abroad. A number of these were sent to the United Kingdom before Japan capitulated and their training is being continued. Furthermore a number of specialists are being trained to facilitate the rebuilding of the Netherlands Air Forces on home soil. The greater part of this rebuilding is taking place in the Netherlands and a number of aerodromes has been taken over for this purpose.

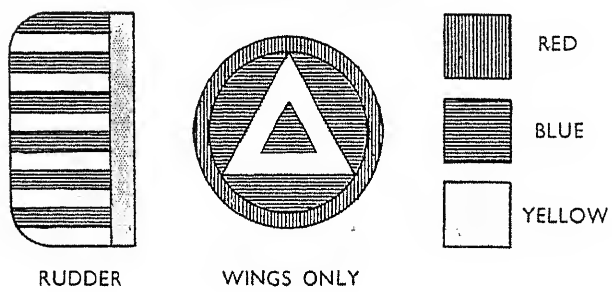
Very little regarding future organization and equipment has as yet been disclosed, except for the plan to amalgamate the Netherlands Army Air Force with the Netherlands East Indies Army Air Force. This will facilitate the exchange of personnel and the co-ordination of training.

With regard to the Naval Air Service, a programme has been set up for the building of several aircraft-carriers which are to be commissioned in 1951. In the meantime, the British light escort-carrier *Nairana* has been transferred to the Netherlands Navy for training purposes and has been renamed the *Kurl Doorman*. The Fairey Firefly and Hawker Sea Fury have been adopted by the Naval Air Service as the standard carrier-fighters. In addition several squadrons equipped with heavy-bomber-reconnaissance and transport aircraft are being formed.

NICARAGUA

(The Republic of Nicaragua—República de Nicaragua)

NATIONAL MARKINGS



The Army Air Force, or Fuerza Aerea de la Guardia Nacional, was formed on June 9, 1938. Its function is to police the Republic, keep order, render assistance in an emergency and to protect the country against enemy invasion. It is administered by the Ministerio de Guerra, Marina y Aviacion, a portfolio held by the President of the Republic.

The Officer Commanding the Fuerza Aerea de la Guardia Nacional is Colonel Guillermo Rivas Cusdra, G.N.

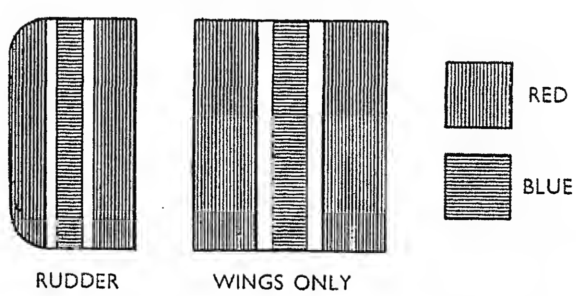
The Fuerza Aerea de la Guardia Aviacion is equipped with about twenty aircraft of American design.

The only purchaser of aircraft and aeronautical supplies in Nicaragua is the Ministry of War and the only flying school in operation is the Aviation School of the Guardia Nacional.

NORWAY

(The Kingdom of Norway—Norge)

NATIONAL MARKINGS



THE ROYAL NORWEGIAN AIR FORCE

A Norwegian Order in Council dated November 10, 1944, united the former separate Army and Naval air services into the Royal Norwegian Air Force. The Commander-in-Chief is Major-General Hjalmar Riiser-Larsen, K.C.B.

The Norwegian squadrons which served with the R.A.F. in Europe included several squadrons in Fighter and Coastal Commands. A Norwegian Fighter Wing consisting of Nos. 321 and 322 (Norwegian) Squadrons served in Fighter Command from 1942 onwards with distinction.

The squadrons in Coastal Command were equipped with Sunderlands, Catalinas and Mosquitos. These squadrons were engaged in convoy escort, shipping reconnaissance and anti-U-boat warfare in the North Atlantic and achieved an excellent record on these operations.

In addition, a considerable number of Norwegian air and ground personnel served at various R.A.F. stations in the United Kingdom, some with the Operational Training Units and at Schools of Technical Training, and some with Operational Squadrons of both the Fighter and Coastal Commands.

The entire cost of the Royal Norwegian Air Forces which served in the United Kingdom, as with all other Norwegian expenditure, was borne by the Norwegian Government in Great Britain, mainly from the income derived from the operations of its maritime fleet.

On May 22, 1945, the two Norwegian fighter squadrons landed at the Gardermœn airfield near Oslo, the first Allied fighters to land in Norway after the liberation, and the nucleus of the new Royal Norwegian Air Force now in process of organzation on Norwegian soil.

The post-war strength of the Royal Norwegian Air Force has been provisionally established to consist of three fighter squadrons, two bomber squadrons, one transport squadron and one naval squadron.

PANAMA

(The Republic of Panama—República de Panama)

Early in 1933 the Republic of Panama decided to replace its marine protective service with a small Air Corps for general police and patrol work. The initial equipment consisted of one Keystone Commuter biplane (300 h.p. Wright Whirlwind engine) and two Travel Air Speedwing biplanes (240 h.p. Wright Whirlwind engines). The latter were equipped with light armament. The Officer Commanding the Panama Air Corps is Capt. Marcos A. Gelabert.

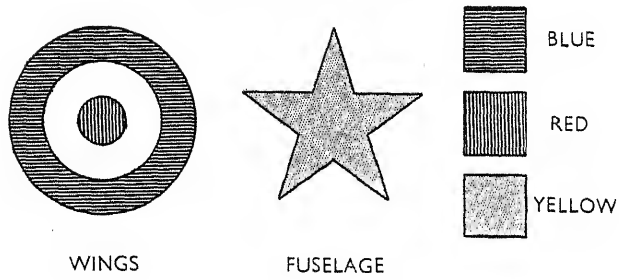
In September, 1941, the Air Corps took delivery of a Luscombe Silvaire two-seat cabin monoplane for use in the flight training of Panama police and Government officials.

In 1941 the Republic of Panama granted rights to the United States Government for the establishment of air bases and defence stations in Panamanian territory to strengthen the Panama Canal defences. These bases and stations come under the jurisdiction of the U.S. Army Air Forces.

PARAGUAY

(Republic of Paraguay—República del Paraguay)

NATIONAL MARKINGS



Military Aviation in Paraguay is organized as part of the Army under the Ministry of War and Marine, Coronel Amancia Pampliega, and includes some naval aircraft and personnel. The Officer Commanding, who may be either a naval or military officer, is responsible to the Minister of War and Marine and also controls Civil Aviation.

The headquarters of the Fuerzas Aereas Nacionales are at the Campo Grande Airport, near Asuncion, which is also the principal Customs Aerodrome in the Republic. There are both landplane and seaplane schools.

The officer Commanding is Major Pablo Stagni.

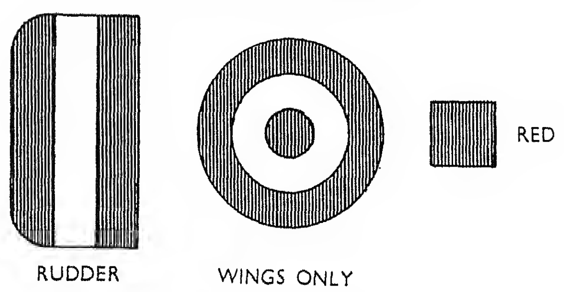
EQUIPMENT

All aircraft used by the Fuerzas Aereas Nacionales are of North American origin.

PERU

(The Republic of Peru—República del Perú)

NATIONAL MARKINGS



THE PERUVIAN AIR CORPS

The Air Arm of Peru, or Cuerpo de Aeronautica del Peru (C.A.P.), uniting under one command both Naval and Military aviation, was instituted by a Supreme Decree dated May 20, 1929.

A Decree signed by President Manuel Prado on November 1, 1941, created an independent Ministry of Aeronautics to control all Military and Civil Aviation in Peru. The new Ministry began to function on January 1, 1942.

ORGANIZATION

Ministerio de Aeronautica, Miraflores, Lima.
Minister of Aeronautics: Ing. Enrique Gongora.
Chief of the Air Staff: General C.A.P. Don Ismael Merino.

The Air Officer Commanding the Air Arm controls all the air services in the country, Civil as well as Military.

OPERATIONAL UNITS

Escuadron de Aviacion No. 1, Chiclayo.
Escuadron de Aviacion No. 4, Ancon.
Escuadron de Aviacion No. 5, Iquitos-Montana.
Escuadrilla No. 6 de Transportes, San Ramon-Montana.
Parque Central de Aeronautica, Callao.

FLYING SCHOOLS

Escuela Central de Aeronautica "George Chavez," Las Palmas.
Escuela de Hydroaviacion, Ancon.

EQUIPMENT

Training :—Stearman, Vultee 54.
Bombing :—Douglas 8A-3P.
Fighting :—Republic Thunderbolt, Curtiss Hawk, North American NA-50.
Transport and Miscellaneous :—Douglas C-47, Barkley-Grow 8TP, Grumman G-21A, Stinson, Junkers Ju 52, Faucett F.19 seaplane.

During the war Peru received sixty-five combat aircraft and two transports from the United States under Lease-Lend.

POLAND

(The Polish Republic—Rzeczpospolita Polska)

Poland was ruthlessly attacked by Germany and invaded by Russia on September 1, 1939, and although the Polish Air Force was quickly overwhelmed by the vastly superior size of the Luftwaffe it put up a gallant fight in the face of tremendous odds. When Poland was eventually defeated a large number of Polish pilots and airmen succeeded in escaping from their country and by various means reached France, where preparations were made for Polish units to be formed to continue the fight against Germany.

With the collapse of France all Polish Air Force personnel crossed to England where, for the third time in one year, the Air Force went into action against the Luftwaffe.

In accordance with the Anglo-Polish Agreement, signed on behalf of the Polish Government by General Sikorski, units of the Polish Air Force were reorganized within the framework of the Royal Air Force.

The Polish Air Force was the largest of the Allied Air Forces which were reformed in the British Isles after the outbreak of War and on the cessation of hostilities in Europe it consisted of fourteen squadrons and the total personnel amounted to 13,000.

Summarising the achievements of the Polish Air Force up to the end of the war in Europe—Polish fighters shot down 741¾ enemy aircraft, with 175 probably destroyed and 238 damaged. In addition, hundreds of locomotives, trucks, tanks, ships, vehicles, etc. were destroyed or damaged. During the same period Polish fighters dropped 3,881,000 lbs. of bombs. Polish bomber squadrons serving in Bomber Command, Coastal Command and with the 2nd Tactical Air Force took part in 1,455 raids with 11,600 aircraft, and dropped 32,000,000 lbs. of bombs on enemy targets. Polish losses were heavy, exceeding 200 per cent. of their original cadre.

This once considerable fighting force is now outlawed by the Polish Government and must submit to disbandment in England. A new Air Force conforming to Russian standards has been formed in Poland. In this all officers holding the rank of major or above are Russians and all instructors and equipment are Russian or of ex-enemy origin. Air Force equipment is entirely Russian and consists of PE-2 bombers, IL-2 ground attack aircraft, YAK-3 fighters and UT-2 trainers.

PORTUGAL

(The Republic of Portugal—República Portuguesa)

Portuguese Service Aviation consists of two branches, the Aeronautica Militar (Army Air Force) and the Aeronautica Naval (Naval Air Service). They belong respectively to and are controlled by the Portuguese Army and Navy.

MILITARY AVIATION

The Aeronautica Militar forms part of the Army, being classed as the "5a Arma" (Fifth Arm).

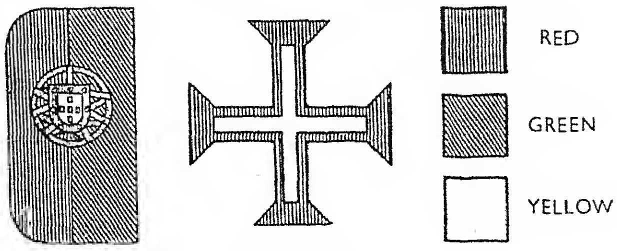
The Command Headquarters is situated in Lisbon at No. 7, Avenida Antonio Augusto de Aguiar. The Officer Commanding is Brig-General Alfredo Delesque dos Santos Sintra, who is responsible to and is under the control of the Minister of War, Lieut. Col. Fernando dos Santos Costa.

ARMY AIR BASES AND ESTABLISHMENTS

The following are the principal Army Air Bases and Establishments :—

PORTUGAL—*continued.*

NATIONAL MARKINGS



RUDDER WINGS ONLY

Granja do Marquez (Sintra)—Aerial Base No. 1. At this base functions the Army Flying School.
Ota—Aerial Base No. 2. Day and Night Bomber Station.
Tancos—Aerial Base No. 3. Fighter Station.

Aircraft and personnel are stationed in the Azores but no details are available.

EQUIPMENT

Supermarine Spitfire (various marks), Hawker Hurricane (at least two marks), Bell Airacobra, Bristol Blenheim IV, Consolidated Liberator, Junkers Ju 86 and Ju 52, Miles Master and Magister, Airspeed Oxford, Avro 626 and D.H. Tiger Moth.

At Alverca do Ribatejo are the Aeronautical Supply Depôt and the General Aeronautical Material Workshops, at which aircraft are overhauled, repaired or reconstructed.

NAVAL AVIATION

The Aeronautica Naval forms part of the Portuguese Navy. It is under the control of the Minister of Marine.

Command Headquarters are situated in one of the buildings of the old Naval Arsenal in the Rua do Arsenal, Lisbon. The officer commanding is Capt. de Fragata Paulo Teixeiro Viana.

NAVAL AIR ESTABLISHMENTS

Bom Sucesso Naval Air Base, Lisbon.

S. Jacinto (Aveiro) Naval Aviation Centre, S. Jacinto Island Aveiro, comprising the Base proper and a Naval Aviation School.

Both the above Bases are fully equipped with buildings and installations.

Faro Emergency Base, Culatra Island. In the extreme South. An emergency base only, having no hangars or other buildings and installations.

The Montijo Naval Air Base. Although this does not exist as a Base proper, work is well advanced to make it a combined sea and landplane base. When completed it will replace Bom Sucesso, which for years has been marked for extinction. Montijo is on the South bank of the Tagus, near Lisbon. Establishments also exist in the Azores and at Macau (China).

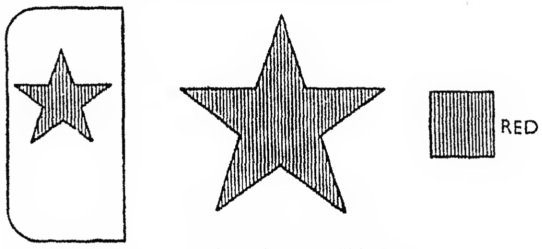
EQUIPMENT.

Short Sunderland I, Grumman G-21B and G-44 Widgeon, Bristol Blenheim, Airspeed Oxford, Miles Martinet and Master, Avro 626, Fleet Trainer (with two different engine installations), D.H. Tiger Moth.

RUSSIA

(The Union of Soviet Socialist Republics—Soyuz Sovietskikh Sotsialistficheskikh Respublik)

NATIONAL MARKINGS



RUDDER FUSELAGE & WINGS

The Air Forces of the Soviet Union form integral parts of the Army and the Navy. Like the Army and the Navy, they are strategically divided between Far East and West. The forces so divided are designed to be independent, with the aim in view of enabling Russia to fight on two fronts.

The largest permanent formation of the Air Forces of the Air Armies is the Air Division, which consists of three Air Regiments, each Air Regiment being normally made up of three Squadrons. Guards Air Divisions and Guards Air Regiments exist, these being units which were specially so designated as a mark of honour for distinguished service in the field.

The Naval Air Components of the Red Fleets are four in number, being those of the Baltic, the Black Sea, the Northern and the Pacific Fleets. They consist of shore-based aircraft, seaplanes and flying-boats. These components are administered by the respective Naval Commands.

The Naval Air Components are organised in Naval Air Divisions and Naval Air Regiments in the same way as the Air Forces of the Red Army. There also exists in these Naval Air Components a considerable number of independent Naval Air Squadrons.

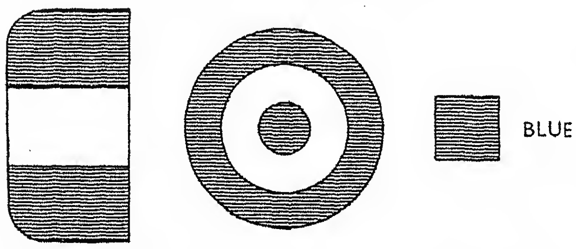
The rôle of the Naval Air Components is predominantly sea reconnaissance, naval escort duties, and anti-shipping operations, but, if occasion demands, they are capable of being, and were frequently used for the support of Army formations in land operations.

In August, 1946, a reorganization of the Soviet fighting services, based on experience gained in the last war, was announced. This was said by Moscow radio to define how the services were to be built up in post-war conditions to safeguard the further growth of the might of the Soviet armed forces.

SALVADOR

(Republic of El Salvador—República de El Salvador)

NATIONAL MARKINGS



RUDDER WINGS ONLY

Military Aviation is administered by a department of the Ministry of National Defence.

ORGANIZATION

Ministerio de Guerra, Marina y Aviacion, Palacio Nacional, San Salvador.

Minister of National Defence: General Don Salvador Peña Trejo.

Departamento de Aviacion

Director :—Major Herman Barón.

This Department is responsible for the administration of both Military and Civil flying in Salvador.

The Military Air Arm is based at Ilopango, where are situated the Headquarters, the Flying Training School, the Technical Training School and Schools for Specialisation.

The Air Arm consists of one Reconnaissance Flight and one Fighter Flight. Each Flight consists of three aircraft in service with one in reserve, and one mobile unit.

SPAIN

(The Spanish State—España)

THE SPANISH AIR FORCE

Military Aviation in Spain is organized as an independent Army of the Air under the jurisdiction of the Air Ministry.

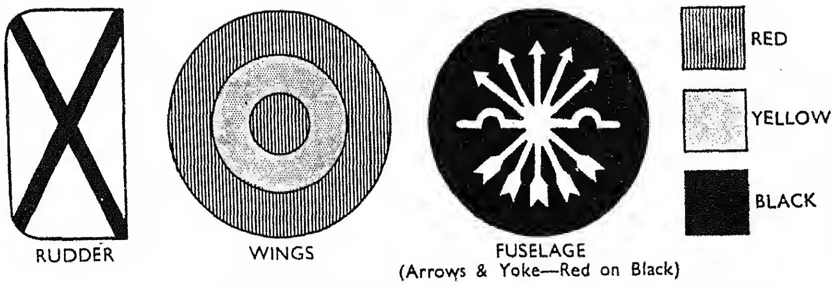
ORGANIZATION

The Army of the Air (Ejercito del Aire) was created in October, 1939, as an independent arm on terms of equality with the Army and the Navy. It is administered by the Air Ministry.

On occasions when the Army, Navy and Air Force may be required to co-operate in a particular mission, the joint command may be undertaken by a general officer of any one of the three services. In such a case his staff will consist of officers drawn from the three services. The Minister of State for each one of the services will continue to control administration and organization within his particular mandate.

SPAIN—*continued.*

NATIONAL MARKINGS



(Arrows & Yoke—Red on Black)

ADMINISTRATION

The Air Ministry (Ministerio del Aire).

The Air Ministry was created in August, 1939, and now conforms to the following organization :—

(1) **The Air Minister** (Ministro del Aire).

(2) **The Air Staff** (Estado Mayor del Aire), consisting of a Chief of Staff, Assistant Chief of Staff, General Secretariat, five Sections and a Control Service (Intervencion).

The Air Staff deals with the organization, instruction and maintenance of the Air Force in peace, and with its mobilisation and operations in time of war.

(3) **The Under-Secretariat** (Sub-secretaria), which controls the following departments :—

- (*a*) **The General-Directorate of Personnel** (Direccion General de Personal), which deals with all questions of recruitment, promotion, commissioning, etc., of military and civil personnel.
- (*b*) **The General-Directorate of Industry and Material** (Direccion General de Industria y Material) which is responsible for the preparation of programmes and the acquisition of aircraft and equipment in accordance with the requirements of the Higher Command.
- (*c*) **The General-Directorate of Ground Services and Facilities** (Direccion General de Infraestructura), which is responsible for the construction and maintenance of aerodromes, buildings and other ground services.
- (*d*) **The General-Directorate of Air Navigation Aids** (Direccion General de Proteccion de Vuelo), which controls all radio services, the issue of meteorological information, and is responsible for airway lighting, beacons, radio beam and direction finding, etc. The National Meteorological Service forms part of this Directorate.
- (*e*) **The General-Directorate of Ground Defence** (Direccion General de Antiaeronautica), which is responsible for all aspects of anti-aircraft ground defence.
- (*f*) **The General-Directorate of Civil Aviation** (Direccion General de Aviacion Civil), which controls all aspects of civil aviation, including commercial flying, private flying, gliding and soaring, pre-military air instruction etc.
- (*g*) **The General-Directorate of Instruction** (Direccion General de Instruccion) which controls the training of all the personnel of the Air Army.
- (*h*) The Sections of Supply (Intendencia), Control (Intervencion), Medical (Sanidad), Pharmacy (Farmacia) and Legal Advice (Asesoria Juridica).

(4) **The National Institute of Aeronautical Science** (Instituto Nacional de Tecnica Aeronautica—I.N.T.A.). Undertakes the study and investigation of all technical problems associated with airframes, aero-engines, propellers, materials, armament, radio, photography, meteorology, etc. This Institute, created in 1942, consists of a Director, Secretary, an Advisory Committee, various sections, experimental workshops and installations, and an aerodrome. It has direct contacts with the Air Minister, the General-Directorate of Industry and Material, the managements of private aeronautical concerns, and similar organizations in the Army and the Navy and the Ministry of National Education.

For the general study of research there is a High Committee (Patronado), which is made up of senior technical and administrative officers of the Air Ministry and other officers and scientists appointed by the War Ministry, the Ministry of Marine, the Academy of Science and other research institutes, and the Aeronautical Industry.

THE ARMY OF THE AIR

The Army of the] Air (Ejercito del Aire) consists of a High Command, the formations of flying and ground personnel, anti-aircraft units, airborne troops, transport, technical and communication services, and supply, medical, legal and other units.

Spanish territory is divided into Air Regions in the peninsula and into Air Zones in Africa and the Colonies.

1a Región Centro. H.Q: Madrid.
2a Región del Estrecho. H.Q.: Seville.
3a Región del Levante. H.Q.: Valencia.
4a Región del Pirineo. H.Q.: Zaragoza.
5a Región del Altantico. H.Q.: Valladolid.
Zona Aéra de Baleares. H.Q.: Palma.
Zona Aérea de Canarias y Africa Occidental. H.Q.: Las Palmas.
Zona Aérea de Marruecos. H.Q.: Tetuan.

Each Region or Zone, which is commanded by a General or Colonel of the Air Force and has its own Regional Air Staff, includes operational and training units and various ancilliary services and establishments.

TRAINING

Instruction in the Air Army is co-ordinated and controlled by the General-Directorate of Instruction (Direccion General de Instruccion), under which are the following establishments :—

Academia General del Aire (General Academy of the Air), San Javier. Here all candidates for commissions in all the Air Army Branches and Services must undergo their initial training. Those for the Air Force, Ground Force or Supply, must complete two courses; those for the Engineering, Medical, Pharmacy, Control and Legal Corps complete half a course. The remainder of the training for all candidates must be completed in the respective specialist academies. This Academy was opened in the Spring of 1945.

Escuela Superior del Aire (Air Staff College).

Academia Especial del Arma de Aviacion (Academy for the Aviation Arm), Alcalá de Henares. Opened in 1944.

Academia Especial del Arma de Tropas de Aviacon (Special Academy for Aviation Troops), Los Alcázares. Opened in 1944.

Academia Militar de Ingenieros Aeronauticos (Military Academy for Aeronautical Engineers).

Escuela Superior Aérontecnica (Higher Aeronautical Technical School).

Institutos de Sanidad Aeronautica (Institute of Aeronautical Medicine).

Academias de Intendencia (Supply), **Intervencion** (Control), **Sanidad** (Medical), **Farmacia** (Pharmacy) and **Juridica** (Legal).

Escuela Inicial Militar Aérea (Military Ab-initio School). For non-commissioned officers (officialidad de complemento) of the Air Force.

Flying personnel receive their instruction in the various elementary and transitional training schools (Escuelas elementales o de transformación) and in the advanced or tactical schools for fighter aircraft, seaplanes, multi-engined aircraft, instrument flying, navigation, etc.

Ground personnel receive their training in the various apprentice schools (Escuelas de Aprendices) attached to the Air Regions. There are specialised schools for engine mechanics, fitters, wireless operators, photographers, armourers, electricians, etc.

Non-flying commissioned personnel in the Control, Supply, Medical and Legal Sections receive their final training in the appropriate military academies or schools of instruction.

Numerous schools under the control of the General-Directorate of Civil Aviation exist for the pre-military training of youth.

EQUIPMENT

The present equipment of the Spanish Air Force is made up of those types which at the end of the Civil War existed in both zones, but owing to lack of spare parts there is a good deal of unserviceability. These are, however, being slowly replaced by more modern types as the capacity of the national industry increases.

SWEDEN

(The Kingdom of Sweden—Sverige)

THE ROYAL SWEDISH AIR FORCE

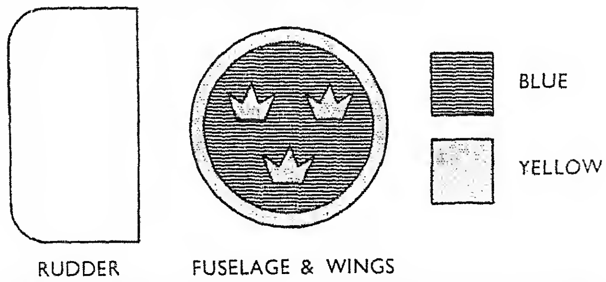
The Swedish Air Force, or Flygvapnet, was organized as an independent force in 1926. Considerable expansion and modernization has been introduced in recent years.

ADMINISTRATION

The Chief of the Air Force (Chefen för Flygvapnet) is in direct subordination to the Commander-in-chief of the Armed Forces (Overbefälhavaren). The central administration (Flygledningen) under the Chief of the Air Force consists of the Air

SWEDEN—*continued.*

NATIONAL MARKINGS



Staff (Flygstaben), the Royal Air Board (Kungl Flygförvaltningen) and the Chief Medical Officer (Flygöverläkaren), all in Stockholm.

ORGANIZATION

Chief of the Air Force (Chefen för Flygvapnet): Lieut.-General B. G. Nordenskiöld.

The Air Staff (Flygstaben). Chief: Major-General Axel Ljungdahl. Deputy Chief: Colonel K. J. A. Silfverberg. Responsible for organization, training of personnel and other matters. It comprises the following departments:—

Operations (Operationsavdelningen).
Organization (Organisationsavdelningen).
Training (Utbildningsavdelningen).
Personnel (Personalavdelning).
Signals (Signalavdelningen).
Flying Safety (Flygsäkerhets-och haveriavdelningen).
Meteorological (Väderleksavdelningen).
Press (Pressektionen).
Staff Headquarters (Expeditionen).

The Royal Air Board (Kungl. Flygförvaltningen). Chief: The Chief of the Air Force. Deputy Chief: Major-General N. O. F. Söderberg.

Responsible for the supply and maintenance of aircraft, aero-engines, fuel equipment, ordnance and finance, as well as of aerodromes and buildings. It comprises:—

Department of Technical Equipment (Materielavdelning). Chief: Colonel B. M. Jacobsson.
Department of Commissariat (Intendenturavdelning).
Department of Aerodromes and Buildings (Byggnadsavdelning).

In addition, there is a **Civil Bureau** (Civilbyrå), for matters of pay, law, etc.

OPERATIONAL UNITS

The Chief of the Air Force command the central administration of the units comprising the Air Force. Under him are four Groups (Flygeskadrar), five Air Base Areas (Flygbasområden) and the following Wings (Flygflottiljer):—

F 1 Kungl Våstmanlands Flygflottilj (Medium Bomber Wing), Västerås.
F 2 Kungl Roslagens Flygflottilj (Tactical Reconnaissance Wing), Hägernäs-Stockholm.
F 3 Kungl Östgöta Flygflottilj (Tactical Reconnaissance Wing), Malmslätt.
F 4 Kungl Jamtlands Flygflottilj (Fighter Wing), Ostersund.
F 6 Kungl Västgöta Flygflottilj (Light Bomber Wing), Karlsborg.
F 7 Kungl Skaraborgs Flygflottilj (Light Bomber Wing), Såtenäs.
F 8 Kungl Svea Flygflottilj (Fighter Wing), Barkarby.
F 9 Kungl Göta Flygflottilj (Fighter Wing), Säve-Göteborg.
F10 Kungl Skanska Flygflottiljen (Fighter Wing), Angelholm.
F11 Kungl Södermanlands Flygflottilj (Long-range Reconnaissance Wing), Nyköping.
F12 Kungl Kalmar Flygflottilj (Fighter Wing), Kalmar.
F13 Kungl Bråvalla Flygflottilj (Fighter Wing), Norrköping.
F14 Kungl Hallands Flyflottilj (Medium Bomber Wing), Halmstad.
F15 Kungl Hälsinge Flygflottilj (Fighter Wing), Söderhamn.
F16 Kungl Upplands Flygflottilj (Fighter Wing), Uppsala.
F17 Kungl Blekinge Flygflottilj (Torpedo-Bomber Wing), Ronneby.
F18 Kungl Södertörns Flygflottilj (Fighter Wing), Tullinge-Stockholm.

In addition there is the

F21 Kungl Norrbottens Flygbaskår (Training unit for Base personnel), Lulea.

Each Wing includes a Headquarters Staff with Meteorological, Aerodrome and Buildings, Commissariat, Medical, Technical Equipment, Signals and Personnel Sections and four Squadrons (Divisioner). Of the four squadrons in each Wing, three are fully operational or training and one is reserved for special duties.

The seventeen Operational Wings are grouped into four Groups. These Groups are constituted as follows:—

1st Air Group (Första Flygeskadern). H.Q.: Stockholm. Nos. 1, 4, 10 and 12 Wings.
2nd Air Group (Andra Flygeskadern). H.Q.: Göteborg. Nos 6, 7, 9 and 14 Wings.
3rd Air Group (Tredje Flygeskadern). H.Q.: Stockholm. Nos. 8, 13, 15, 16 and 18 Wings.
4th Air Group (Fjärde Flygeskadern). H.Q.: Stockholm. Nos. 2, 3, 11 and 17 Wings.

There are three Aircraft Depots (Centrala Flygverkstäder) with repair workshops at Malmslätt, Västerås and Arboga.

The Air Estimates for the fiscal year 1946/47, beginning July 1, 1946, amount to Kr. 250,000,000.

TRAINING

The following are the principal training establishments:—

F 5 Kungl Krigsflygskolan (Flying Training School), Ljungbyhed.
F 20 Kungl Flygkadettskolna (Air Force College), Uppsala.
Flygkrigskögskolan (Air Staff College), Stockholm.
Flygvapnets Centrala Skolor (Technical Training Centre), Västerås
Flygvapnets Bomb-och Skjutskola (Armament Training Unit), Stockholm and Luleå.

Officer cadets are trained at the Flying Training School at Ljungbyhed and the Air Force College at Uppsala. The training period is about 34 months. The training includes one year with an Air Force Wing for operational training.

Observers for reconnaissance units are generally Army or Navy officers who have applied for such training.

The first period of enlistment for airmen is four years. Regular non-commissioned pilots are enlisted for six years. A considerable number of conscripts are used in the ground staffs. Recent legislation has extended the period of training of all Air Force conscripts to 450 days, of which 360 days are served in one sequence.

DESIGNATION OF MILITARY AIRCRAFT

All Swedish service aircraft are officially identified by the following class letters:—

B	Bombers.	**P**	Experimental.
T	Torpedo-bombers.	**Tp**	Transport or Ambulance.
J	Fighters.	**G**	Gliders.
S	Reconnaissance.	**Se**	Sailplane.
Sk	Training.		

In each class the different types of aircraft are numbered consecutively. A capital letter (A, B, C, etc.) after the type number denotes variations in engines, equipment, etc.

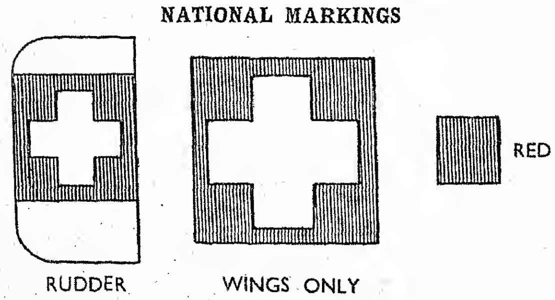
EQUIPMENT

Bombing (B):—B 17 (SAAB-17), B 18 (SAAB-18), B 21 (SAAB-21).
Fighting (J):—J 21 (SAAB-21), J 22, J 26 (North-American Mustang P-51D), J 28 (de Havilland Vampire).
Reconnaissance (S):—S 14 (Fieseler Storch), S 17 (SAAB-17), S 18 (SAAB-18).
Torpedo-Bombing (T):—T 18 (SAAB-18).
Transport or Ambulance (Tp):—Tp 2A (Junkers W 34 ambulance) Tp 3 (Beechcraft 18 S ambulance), Tp 5 (Junkers Ju 52).
Training (Sk):—Sk 14 (North American NA-16), Sk 15 (Klemm Kl 35), Sk 25 (Bücker Bestmann).

SWITZERLAND

(The Swiss Federation—Schweizerische Eidgenossenschaft)

NATIONAL MARKINGS



THE SWISS AIR FORCE

The Swiss Air Force became an independent service by virtue of a Decree dated October 13, 1936. It is administered by a Branch of the Federal Military Department.

ORGANIZATION

Federal Military Department (Eidgenössisches Militärdepartement) Berne.

Air Force and Anti-Aircraft Division (Abteilung fur Flugwesen and Fliegerabwehr)

Officers Commanding: Colonel-Divisonnaire F. Rihner.

This division or branch has sections for Organization; Personnel and Material; Technical Services; Air Defence Warning Service; Military Aerodromes and Ground Defence.

SWITZERLAND—*continued*.

The Air Force, the headquarters and principal services of which are situated at Dübendorf, near Zürich, is composed of four Regiments, each containing two Groups. A Group is made up of three squadrons and, of the twenty-four squadrons so formed, fifteen are fighter, six are reconnaissance and three are training squadrons (two fighter and one reconnaissance).

Training.

Operational training is carried out in a Training Group which is the nucleus of the regular Air Force and the only tactical training unit. In this Group officers and N.C.O.'s are trained as air-crews. Until 1943 officers only were trained as pilots but since that date specially selected N.C.O.'s have been trained.

EQUIPMENT

Reconnaissance :—C.25, C.36 and Fieseler Storch.

Fighting :—D.H. Vampire, Messerschmitt Me 109E.

Training :—Bücker Bü 131 Jungmann, Bü 133 Jungmeister Messerschmitt Me 108 Taifun.

The chief assembly factories are the branch of the Dornier Werke at Altenrhein, the Federal Aircraft Works at Thun and Emmen and the Pilatus Works at Stan. The last mentioned is occupied mainly with repair work.

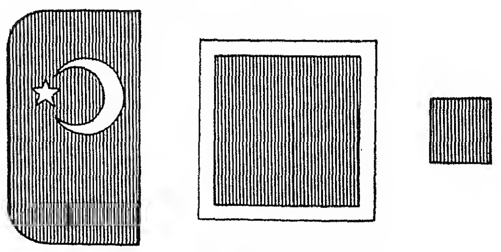
SYRIA

The nucleus of a Syrian Air Force has been established. A military flying school has been formed at Mazza, near Damascus and four Egyptian Air Force pilots have been engaged to serve as instructors.

TURKEY

(The Turkish Republic—Türkiye)

NATIONAL MARKINGS



RUDDER WINGS ONLY

THE TURKISH AIR FORCE

The Turkish Air Force forms an integral part of the Turkish Army. It is controlled politically by the Minister of National Defence and operationally by the Air Bureau of the Turkish General Staff.

Ministry of National Defence, Ankara.

Minister of National Defence : General Ali Riza Artunkal.

Under Secretary of State for Air : Lieut-Gen. Yahya Razi Biltan, who is responsible to the Minister of National Defence for administration, personnel, schools and factories, as well as for the purchase of aircraft and supplies.

Chief of the General Staff : General Sefik Zakmak, who is also Director-General of Military Aviation and in supreme command of the Air Force and responsible for operations and training.

The General Staff includes an Air Bureau, under Major-General Zeki Dogan, who is assisted by a number of General Staff officers of both the military and air branches.

ORGANIZATION

The Turkish Air Force is organized in two Air Divisions, the 1st with its Headquarters at Eskishehr, the 2nd with its Headquarters at Gaziemir. The Air Division contains a variable number of Wings, a Wing normally being made up of two Squadrons. There are altogether approximately fifteen Wings, containing about thirty Squadrons, in the Air Force.

The Squadron is the tactical unit, the first line strength of a Squadron being nine aircraft in the case of Fighter and Army co-operation Squadrons, and six aircraft in the case of Bomber Squadrons.

TRAINING

Prior to 1938 the Turkish Air Force grew chiefly undor French tuition, but from that date R.A.F. instructors were brought in and the training system was remodelled on British lines.

Flying training is carried out at Eskishehr where there are the Initial, Elementary, Intermediate and Advanced Training Wings. Operational training for bomber pilots is also undertaken at Eskishehr. Fighter pilots, however, pass straight to their units after completion of their Advanced Training course.

EQUIPMENT

Heavy Bomber : Consolidated Liberator.

Medium Bomber : Martin 139 and Baltimore.

Light Bomber : Bristol Blenheim, D.H. Mosquito.

Fighter : Hawker Hurricane IIB and IIC, Supermarine Spitfire, Focke-Wulf Fw 190.

Army Co-operation : Westland Lysander.

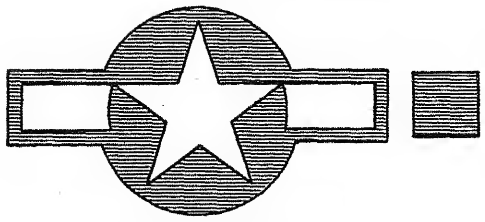
Torpedo Bomber : Bristol Beaufort.

Training :—Miles Magister, Vultee V-11, Curtiss Hawk, Curtiss Falcon, Gotha Go. 145, Miles Master, Airspeed Oxford, P.Z.L. 24 and Morane-Saulnier 406. Difficulty in obtaining spare parts makes unserviceability rather high.

The Aircraft Factory at Kaiseri builds a number of types under licence. It is the principal repair centre, but another repair depôt exists at Eskishehr.

THE UNITED STATES OF AMERICA

NATIONAL MARKINGS



FUSELAGE & WINGS

Service Aviation in the United States is organized in two separate arms—the Army Air Forces and the Naval Air Service, the latter including Marine Corps Aviation.

The Commander-in-Chief of the Fighting Forces is the President of the United States.

THE ARMY AIR FORCES

On March 2nd, 1942, a drastic reorganization was approved whereby all branches of the Army were abolished in favour of three main autonomous commands—Air Forces, Ground Forces, and Service of Supply—all of which are responsible directly to the General Staff. The placing of the Air Forces under a single command resulted in the abolition of the Air Corps and Combat Command. General of the Army H. H. Arnold was Commander-in-Chief of the Air Forces from March, 1942, until February, 1946, when he retired. He was succeeded by General Carl Spaatz.

Further reorganization in March, 1943, established six Assistant Chiefs of Staff, to direct and control the activities of the Air Forces. This reorganization resulted in:—(*a*) Headquarters, Army Air Forces, being relieved of details of execution and being left free to determine overall policy; (*b*) the creation of a more cohesive organization within the Headquarters; and (*c*) the delegation of greater responsibility to field commanders.

A further reorganization of the War Department took place in May, 1946, abolishing the Service of Supply, mentioned above, and considerably increasing the autonomy of the Army Air Forces. The effect of this move has been to achieve a complete and intact Air Force, based on post-war requirements, so that in the event of its gaining parity with Army Ground Forces and the Navy, it could immediately stand on its own feet and operate as an independent Air Force. The Service of Supply has been incorporated in the Army Ground Forces, and the number of Assistant Chiefs of Air Staff reduced from six to five.

A peace time Air Force of 419,355 officers and enlisted men, organized into 70 groups, is planned. Of these groups, 25 would be Very Heavy Bombardment, 25 Fighter, 5 Light Bombardment, 10 Transport, and 5 Tactical Reconnaissance Groups. Plans

UNITED STATES—*continued.*

also call for 49 separate squadrons, consisting of transport, tactical reconnaissance, night fighter, weather reconnaissance, mapping liaison, and emergency rescue units. The total aircraft requirements for these groups would be 5,200 for first-line tactical use, 2,300 for training and 500 for air transport.

An Air Reserve and Air National Guard have been formed as an integral part of the air defence structure of the United States. The Air National Guard will provide a reserve component of the Air Forces capable of rapid expansion to war strength and able to furnish air units fit for immediate service anywhere in the World. The Air Reserve will furnish, in the event of emergency, additional trained commissioned and enlisted men for necessary replacements and expansion of the Air Forces. These units, effectively organized and trained in time of peace for rapid mobilization, expansion and deployment, will, together with the Regular Air Forces and the Air National Guard, constitute a balanced Air Force. Requirements for the Air Reserve and Air National Guard would add 6,000 aircraft of all types. Thus, overall aircraft requirements would be approximately 14,000 aeroplanes.

ORGANIZATION.

The War Department, Washington, D.C.

Secretary of War: Robert L. Patterson.

Assistant Secretary of War for Air: W. Stuart Symington.

Chief of the General Staff; General of the Army Dwight D. Eisenhower.

Commanding General, U.S. Army Air Forces: General Carl Spaatz.

The Commanding General, Army Air Forces, is responsible for the fulfilment of the mission of the Air Forces under policies prescribed by the Chief of the General Staff.

While the overall policies of the Army Air Forces are determined by the Commanding General, the Assistant Chiefs of Staff translate them into needs in terms of manpower and equipment. They direct acquisition of manpower, the creation of the machines, and allocate them for training and combat use.

AIR STAFF

Immediately below the Commanding General, Army Air Forces, is the post of Deputy Commanding General and Chief of the Air Staff. There are two Deputy Chiefs of Staff, one technical, entitled "Deputy Chief of Staff for Research and Development," and the other administrative, entitled "Deputy Chief of Staff for Administration."

Then follow five Assistant Chiefs of Staff, whose functions are set out below:—

The Assistant Chief of Air Staff—1, supervises the personnel programme of the Army Air Forces, including procurement, classification and assignment of individuals, both military and civilian.

The Assistant Chief of Air Staff—2, is responsible for the collection and dissemination of all Air Intelligence information.

The Assistant Chief of Air Staff—3, is responsible for operations and training. He determines the tactics and technique of aerial warfare. He also determines requirements for trained personnel, and aircraft, equipment and supplies, and allocates the operational fighting teams to the theatres of operation as required.

The Assistant Chief of Air Staff—4, supervises the material procurement and logistical programme of the Air Forces, including research, development and procurement of aircraft, equipment and supplies, and their maintenance and distribution.

The Assistant Chief of Air Staff—5, represents the Commanding General in the formation of strategic plans for the staff planning agencies of the United States and its allies.

In addition, the Air Staff includes the Director of Information (Brigadier-General E. O'Donnell), the Air Inspector (Major-General J. W. Jones), the Air Adjutant General (Colonel H. G. Culton), the Air Comptroller (Brigadier-General G. Gardner), together with the Secretary to the Air Board (Major-General H. J. Knerr).

OPERATIONAL COMMANDS

Since VJ-Day the operational commands have undergone considerable re-shuffle. Apart from the air components of the U.S. occupational forces overseas, three major Air Commands have been established within the continental United States. These are as follows:—

Strategic Air Command. Headquarters: Bolling Field, Washington, D.C.

This command organizes, trains and maintains a global air striking force to be employed and sustained as directed by the Commanding General. It not only trains a bombardment force, suitable for very long range operations, but also controls training and operation of long range fighter escorts and PR aircraft to work for the bomber force. At present, the only active subordinate commands controlled by the Strategic Air Force are the Eighth and Fifteenth Air Forces. Eventually, the Strategic Air Command will be composed of three Air Forces, which will include 21 Very Heavy Bomber groups, 12 VLR Fighter groups and 3 VLR Reconnaissance groups.

Air Defence Command. Headquarters: Mitchel Field, Long Island, N.Y.

This command provides for the defence of the United States. To this end, it organizes and maintains the active fighter squadrons, as well as controlling the reserve forces of the Air National Guard and Air Reserve.

The Air National Guard will provide a first-call group in the event of emergency mobilisation, and depends on action by individual States. The programme, which originated in April, 1946, will consist of twelve Wings, composed of twenty-four Fighter groups and three Light Bombardment groups. Approximately 3,000 pilots, 2,800 non-rated officers and 50,000 enlisted men will comprise this force, forming 84 squadrons to be based at 79 airfields throughout the nation. They will be trained by regular Army Air Force personnel. Units will be equipped with P-51 and P-47 fighters and A-26 light bombers. Jet-propelled fighters will be used when available.

The Active Air Reserve will consist of 17,500 pilots, 5,000 additional staff pilots, 27,000 non-flying officers and 120,000 enlisted men. All will be in constant training, but in varying stages of preparedness.

It also controls the air-raid warning units and such anti-aircraft units as are assigned to its command. The command is divided into six defence areas, whose individual Headquarters are located in the vicinity of the six Army Ground Force Area Headquarters within the continental United States.

The air forces allocated to the Air Defence Command, stationed in each of the defence areas, are as follows:—

First Air Force:—Fort Slocum, New Rochelle, New York.
Second Air Force:—Fort Creek, Omaha, Nebraska.
Fourth Air Force:—Hamilton Field, San Francisco, California.
Tenth Air Force:—Brooks Field, San Antonio, Texas.
Eleventh Air Force:—Harrisburg, Pennsylvania.
Fourteenth Air Force:—Orlando, Florida.

Tactical Air Command. Headquarters: Langley Field, Virginia.

This command is charged with maintaining combat units skilled in the art of joint operations with ground and sea forces. It also promotes the progressive development of air-to-ground co-ordination techniques and doctrines. The Tactical Air Command consists at present of three separate Air Forces, the Third Air Force, principally a troop-carrier force embodying the remains of the old Troop Carrier Command; the Ninth Air Force, consisting of fighter aircraft, light and medium bomber and P.R. groups; and the Twelfth Air Force, having fighter aircraft only. These Air Forces are located as follows:—

Third Air Force:—Greenville, S.C.
Ninth Air Force:—Briggs Field, El Paso, Tex.
Twelfth Air Force:—March Field, Cal.

NON-OPERATIONAL COMMANDS

There are five supporting Commands, also situated within the United States, as follows:—

Air Materiel Command. Headquarters: Wright Field, Dayton, Ohio.

The responsibilities of this Command, which has now absorbed the Air Service Command, cover all research and development work on materials and equipment for the Air Forces. It carries out all logistical work necessary for both equipment and raw materials, and it is responsible for the supply services of all the Air Forces wherever they may be situated.

Close liaison is maintained with the Air Proving Ground Command, which as will be seen from the next sub-section, is responsible for all tactical testing or equipment after it has passed the prototype stage.

The Command has four main operating sections, the Engineering Division, the Procurement Division, the Production Division and the Inspection Division.

The Air Proving Ground Command. Headquarters: Eglin Field, Florida.

It is divided into two main subordinate divisions, namely, the Air Forces Board and the Air Forces Proving Ground. The former recommends to Headquarters, Army Air Forces, action to be taken as a result of tests and experimental work on all kinds of Air Force material. It works out doctrines and training techniques required for various new types of combat equipment. It plans and supervises the development, under simulated combat conditions, of new tactics in air warfare, and makes recommendations on such work to Headquarters, Army Air Forces.

The other subordinate division, the Air Proving Ground, actually conducts the tests on materials and equipment, and carries out tactical tests on the operational techniques outlined above. In general, it provides such facilities and assistance to the Air Materiel Command as may be necessary to complete engineering and development tests.

The Air Transport Command. Headquarters: Gravelly Point, Virginia.

The Air Transport Command is charged with providing air transport, airways communications, maps and route books, and air/sea rescue facilities for the Air Forces on a global scale. It has been severely cut down since VJ-Day, when it operated approximately 336 bases over a distance of 170,000 foreign and domestic route miles. At the time of writing (September, 1946), it had four major divisions, the Pacific Division, with Headquarters at San Francisco; the Continental Division, Headquarters at Memphis, Tennessee; the Atlantic Division, Headquarters at Fort Totten, New York; and the European Division, with Headquarters at Frankfurt, Germany.

UNITED STATES—*continued.*

The Air Training Command. Headquarters: Barksdale Field, Louisiana.

There are two sub-commands within this organization, the Flying Training Command, with Headquarters at Randolph Field, Texas, which, as its name implies, is responsible for all aircrew training; and the Technical Training Command, Headquarters at Scott Field, Illinois, which trains ground crews and administrative personnel.

Training Command installations stretch over a wide southern belt of the United States where bad weather seldom interferes with training. There has been considerable re-organization and re-shuffling of units within this command, and at the moment it is engaged in re-drafting training curricula and schedules for the postwar Air Force.

This command is also responsible for Air Force entries under the Universal Military Training Act, for the Air Reserve officers' training courses, and for the Army Air Forces extension courses. It is not responsible for staff colleges, which come under a separate command called the Air University.

The Air University. Headquarters: Maxwell Field, Alabama. This is an "exempted" command and has right of direct access to the Commanding General, Army Air Forces, on all policy matters. It supervises all Army Air Forces schools and colleges, and exercises broad supervision over the syllabus or the Army Air Forces Institute of Technology at Wright Field, which is actually administered by the Air Materiel Command.

At present the Air University consists of five separate schools and colleges. These are as follows:—the Air War College, and the Air Command and Staff School, both at Maxwell Field, Alabama; the Air Tactical School at Tyndall Field, Florida; the Special Staff School (Communications) at Gunter Field, Alabama; and School of Medicine, which is located at Randolph Field, Texas.

NAVAL AVIATION

United States Naval Aviation is part of the Naval Organization and is under the direction of the Secretary of the Navy.

ADMINISTRATION

The Navy Department, Washington, D.C.

Secretary of the Navy: James V. Forrestal.

Assistant Secretary of the Navy for Air: John Nicholas Brown.

Chief of Naval Operations: Fleet Admiral Chester W. Nimitz.

Vice-Chief of Naval Operations: Vice-Admiral deWitt C. Ramsey.

Deputy Chief of Naval Operations for Air: Vice-Admiral Arthur W. Radford.

The function of the office of the Assistant Secretary of the Navy for Air is the supervision of naval aeronautics and the co-ordination of its activities with other Government agencies. It also acts as liaison between the Bureau of Aeronautics and the aircraft manufacturers and handles details of aircraft procurement.

The Deputy Chief of Naval operations for Air correlates and co-ordinates all military aspects of Naval Aviation within the Navy Department.

The Fleet Air Force Commanders assume a certain authority over the aircraft-carrier divisions of the Fleets and serve as principal air advisers to the Commanders-in-Chief.

Bureau of Aeronautics, Washington, D.C.

Chief of the Bureau: Rear Admiral Harold B. Sallada.

The Bureau of Aeronautics is responsible for the design, procurement and upkeep of naval aircraft and aircraft equipment, and the training of naval air personnel.

ORGANIZATION

The Aircraft Squadron is the standard administrative and tactical unit in all naval operations. Squadrons consist of from six to thirty-six or more aircraft according to type and mission. Squadrons are divided into Divisions. Two or more Sections of two or three aircraft form a Division. A standard Carrier Air Group consists of four 18-plane squadrons. Marine Air Groups and Wings and Navy shore-based formations vary in strength according to function. Patrol and Search aircraft form Fleet Air Wings.

TRAINING

The personnel of U.S. Naval Aviation is composed of (1) regular Naval officers who, on completion of training are designated as Naval Aviators; (2) enlisted men of the regular Navy who receive designations as Naval Aviation Pilots; and (3) Naval Aviation Cadets who, upon graduation, are designated as Naval Aviators and receive commissions as Ensigns in the Naval Reserve.

The Navy plans a Ready Air Reserve of 28,700 Naval and Marine personnel in inactive duty status to be trained in a closely integrated programme with the Regular Navy.

Fifteen Naval Air Stations in the United States have been designated for the exclusive mission of training Air Reserves. Seven additional air stations will train Reserves besides fulfilling other missions. These stations will have available the most modern aircraft, equipment and techniques as they are developed by Naval Aviation, with the aim that the Reserves at all times will maintain Fleet proficiency.

The Ready Reserve will be composed of 6,100 Naval and Marine aviators, 2,800 ground officers and 19,800 enlisted Naval and Marine personnel. They will be organized into air groups, squadrons and units trained to man in an emergency the ships laid up in the Inactive Fleet, or to supplement squadrons of the Active and Reserve Fleets. Reserve Marine squadrons will be organized separately in order to complement carriers assigned to the Marines and to train for operation with the Fleet Marine Force.

The Navy Air Reserve will consist of 15 Large, 5 Medium and 35 Escort Carrier Groups: 45 Observation squadrons; 21 Patrol-Bomber squadrons and 24 Transport squadrons. The Marine Air Reserve will consist of 24 Fighter squadrons and 4 Ground Control Intercept squadrons (radar-equipped air warning and fighter direction units).

The Chief of Naval Air Reserve Training is Rear-Admiral Edward C. Ewer, U.S.N. and the Officer Commanding, Marine Air Reserve, is Brig. Gen. C. F. Schilt, M.C., both with headquarters at Glenview, near Chicago, Ill.

NAVAL AIR TRANSPORT

A Naval Air Transport Service was authorised on December 12, 1941, as a section of the Naval Transportation Service, a division of the Office of the Chief of Naval Operations. Early in 1942 it was transferred, together with all other aviation activities, to a newly-formed Aviation Division of the Office of the Chief of Naval Operations.

MARINE CORPS AVIATION

Headquarters, U.S. Marine Corps, Washington, D.C.

Director of Marine Corps Aviation: Major-General Field Harris.

Marine Corps Aviation is an integral part of Naval Aviation and its mission is to furnish the Air Forces necessary to the Fleet Marine Force, Carrier Operations with the Fleet and for expeditionary duty, marine advanced base operations and the defence of naval bases outside the continental United States which are defended on shore by the Marines. Its officers are either detailed to aviation duty from permanent line officers of the Corps or are recruited as aviation cadets and appointed to the Marine Corps Reserve. Its enlisted men are marines specially trained for aviation duty. A number of enlisted men are selected each year for flight training.

The administration, training and operations of Marine Corps Aviation are directed by the Director of Aviation Headquarters, U.S. Marine Corps, who is also attached to the Bureau of Aeronautics and whose office also constitutes a division of Headquarters, U.S. Marine Corps.

The air training of Marine Corps aviation personnel has been co-ordinated with Naval air training since July 1, 1941. Qualified personnel recruited by the Marine Corps now pass through the prescribed course for naval aviation cadets on completion of the course may apply for appointment as Second Lieutenants, U.S. Marine Corps Reserve.

All aviation material used in Marine aviation is procured by the Navy. In general the same types of aircraft are used. Tactical squadrons have a similar organization. Radio, ordnance equipment and motor transport are identical to those of the Navy.

THE U.S. COAST GUARD

The U.S. Coast Guard constitutes a part of the military forces of the United States, operating under the Treasury in time of peace and the Navy in war. Its principal peacetime duties are the enforcement of maritime and customs laws, operation of aids to navigation, protection of fisheries, iceberg patrol, the saving of life at sea and the rendering of assistance to ships in distress.

Coast Guard pilots receive their training at the Naval Air Station at Pensacola, Fla., after having had at least three years' service at sea as commissioned officers.

Headquarters, U.S. Coast Guard:—Washington, D.C.

Commandant: Admiral J. F. Farley, U.S.C.G.

Assistant Commandant (Chief Operations Officer): Rear Admiral Merlin O'Neill, U.S.C.G.

Chief, Office of Air/Sea Rescue: Rear-Admiral Robert Donahue.

Chief, Aviation Division: Commander W. E. Sinton.

Engineer-in-Chief: Rear-Admiral H. F. Johnson.

Chief Aviation Operations Officer: Commander S. C. Linholm, U.S.C.G.

Coast Guard Air Stations

Salem, Mass. (Winter Island). Seaplanes only.

New York, N.Y. (Floyd Bennett Field). Seaplanes and landplanes.

Elizabeth City, N.C. (Davis Bay, Pasquotank River). Seaplanes and landplanes.

Miami, Fla. (Dinner Key). Seaplanes only.

St. Petersburg, Fla. (Albert Whitted Field). Seaplanes and landplanes.

Biloxi, Miss. (Cadet Point). Seaplanes only.

San Diego, Cal. (Lindbergh Field). Seaplanes and landplanes.

San Francisco, Cal. (San Francisco Municipal Field). Seaplanes and landplanes.

Port Angeles, Wash. (Ediz Hook). Seaplanes and landplanes.

There are air patrol detachments at Cape May, N.J., Traverse City, Mich., and El Paso, Texas.

URUGUAY

(The Republic of Uruguay—República Oriental del Uruguay)

NATIONAL MARKINGS

MILITARY AVIATION

In 1936 Uruguayan military aviation was reorganized and the newly-created Directorate of Military Aeronautics being placed under the supervision of the Minister of National Defence. The Director, Colonel Don Oscar D. Gestido, is responsible for Military and Civil Aviation to the Minister of Defence through the Inspector-General of the Army.

ORGANIZATION

Ministerio de Defensa Nacional, Calle 25 de Mayo 279, Montevideo.

Dirección General de la Aeronáutica Militar, Calle Lucas Obes 897, Montevideo. Director-General: Colonel Oscar D. Gestido. Chief of Air Staff: Colonel Medardo R. Farías. Deputy Chief of Air Staff: Lieutenant Colonel Gustavo Bernadou. Adjutant General: Major Tomás R. Mega.

The General-Directorate and Headquarters Staff control, the School of Military Aeronautics, two tactical units and the Air Arsenal. The Headquarters Staff includes the Central Department and the following divisions:—

Central Department. Chief: Capt. Arturo Sasso Alegre.
1st Section (Organization). Chief: Capt. Juan José Scasso.
2nd Section (Service). Chief: Capt. Adolfo E. Roca.
3rd Section (Information). Chief: Capt. Juan Carlos Jorge.
4th Section (Op ·ations). Chief: Capt. Eladio Silvera.

The active tactical and service units are:—

Base Aeronáutica No. 1, "Capitán Boiso Lanza" Aerodrome. Camino Pedro de Medoza No. 5553, Montevideo. Commanding Officer: Lieut. Col. Isaías F. Sánchez. Reconnaissance and Attack Squadrons and the Bombing Group. Also Communications Service.

Base Aeronàutica No. 2, "Teniente 2 Mario W. Paralla," Aerodrome, Estación Yi, Dpto. de Durazno. Commanding Officer: Lieut. Col. Marinao Ríos Gianola. Reconnaissance and Fighter Squadrons. Also Communications Service.

Escuela Militar de Aeronáutica, "General Artigas," Aerodrome, Pando, Dpto. de Canelones. Director of the School of Aeronautics: Lieut. Col. Oscar M. Sánchez. Trains pilots up to qualifying as military aviators.

Dirección General de Talleres, Almacenes Generales y Servicios, "Capitán Boiso Lanza" Aerodrome, Montevideo. Director of the Air Arsenal: Lieut. Col. Conrado A. Saez. Includes a Workshop Division, General Stores, Medical Service and Laboratory.

EQUIPMENT

Mainly of American origin. Uruguay received about forty aircraft from the United States under Lease Lend.

NAVAL AIR SERVICE

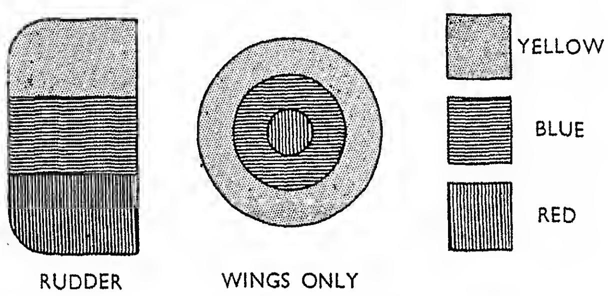
The **Servicio Aeronautica de la Marina** is under the control of the Inspector-General of the Navy. Its Chief is Capitan de Corbeta Don Horacio del Pilar Bogarin.

The General Command of this Service is on the Isla Libertad, where also is the Air Base No. 1. The Technical Division (Officer Commanding: Ten. de Navio C.I.M.E. Carlos Martinez Labadie) is also situated there. Other Bases are on the Laguna Negra, Laguna del Sauce, in the port of La Paloma and at Punta del Este, all on the River Plate estuary. It is only of late that naval flying has had any significance and the service is still in its infancy. All the material is new—of American production—and ambitious plans are under consideration for the enlargement of its general capacity, equipment and facilities. Many flying officers have proceeded to the United States for advanced instruction.

VENEZUELA

(The Republic of Venezuela—Estados Unidos de Venezuela)

NATIONAL MARKINGS



MILITARY AVIATION

Military Aviation is directly controlled by the Inspector-General of the Army, under the administration of the Ministry for War and Marine.

ORGANIZATION

Ministerio de Guerra y Marina, Direccion General de Aviacion, Caracas.
Director of Military Aviation: Major Luis A. Calderon.
Inspector-General of Aviation: Major Carlos Maldonado.

Regimiento de Aviacion Militar.
Headquarters: Maracay.
This regiment includes all operational units.

Escuela de Aviacion Militar, Maracay.
Director: Major Felix R. Mareno.
This school trains pilots and specialists in rigging, aero-engines, armament, radio, and photography. Both pilotage and technical courses are of one year's duration.
Air Force pilots do tours of duty as First Pilots with the Government-operated Linea Aeropostal Venezolana to give them navigational and cross-country flying experience.

EQUIPMENT

Venezuelan military aviation operates about 100 aircraft, namely trainers of U.S. origin. During the war a small number of aircraft was received from the United States under Lease/Lend.

YUGOSLAVIA

The People's Republic of Yugoslavia falls within that part of Eastern Europe which is now under Russian influence. That a Jugoslav Air Force does exist was demonstrated in 1946 when two unarmed American transport aircraft were deliberately shot down by Yugoslav fighter aircraft for alleged trespass of Jugoslav territory. Details of its organization or other functions are not known, but it is believed to have units at airfields throughout the country, and to use Russian equipment exclusively.

A REVIEW OF THE WORLD'S CIVIL AVIATION

ARRANGED IN
ALPHABETICAL ORDER OF NATIONS

A RECORD OF CIVIL AVIATION DURING 1946, WHICH INCLUDES THE NAMES AND ADDRESSES OF THE AERONAUTICAL DEPARTMENTS, ASSOCIATIONS, TRANSPORT COMPANIES, FLYING CLUBS, SCHOOLS, PUBLICATIONS, ETC. OF ALL NATIONS

INTERNATIONAL AIRCRAFT MARKINGS

AN- Nicaragua.
CC- Chile.
CF- Canada.
CN- Morocco.
CP- or **CB-** Bolivia.
CR- Portuguese Colonies.
CS- Portugal.
CU- Cuba.
CX- Uruguay.
CZ- Principality of Monaco.
EC- Spain.
EI- Eire.
EP- Iran (Persia).
ET- Ethiopia.
F- France, Colonies and Protectorates, less Morocco.
G- United Kingdom.
HA- Hungary.
HB- Switzerland.
HC- Ecuador.
HH- Haiti.
HI- Dominican Republic.
HK- Colombia.
HS- Siam.
I- Italy.
LG- Guatemala.
LI- Liberia.
LN- Norway.
LR- Lebanon
LV- Argentine Republic.
LX- Luxembourg.
LZ- Bulgaria.
MC- Monte Carlo.
N United States of America (*see below)
OB- Peru.
OH- Finland.
OK- Czechoslovakia.
OO- Belgium.
OY- Denmark.
PH- Netherlands.
PI- Philippine Commonwealth.
PJ- Curaçao (Netherlands West Indies).
PK- Netherlands East Indies.
PP- or **PT-** Brazil.
PZ- Suriname (Netherlands Guiana).
RX- Republic of Panama.
SE- Sweden.
SP- Poland.
SU- Egypt.
SX- Greece.
TC- Turkey.
TF- Iceland.
TI- Costa Rica.
TJ- Transjordan.
URSS Russia (national letters followed by a number).
VH- Australia.
VO- Newfoundland.
VP- **VQ-** **VR-** British Colonies, Protectorates and Mandates as below :—

VP-AAA—VP-AZZ Gold Coast with Ashanti, Northern Territories of Gold Coast in British Togoland.
VP-BAA—VP-BZZ Bahamas.
VP-CAA—VP-CZZ Ceylon.
VP-FAA—VP-FZZ Falkland Islands.
VP-GAA—VP-GZZ British Guiana.
VP-HAA—VP-HZZ British Honduras.
VP-JAA—VP-JZZ Jamaica.
VP-KAA—VP-KZZ Colonies and the Protectorate of Kenya.
VP-LAA VP-LZZ Leeward Islands.
VP-MAA—VP-MZZ Malta.
VP-NAA—VP-NZZ Protectorate of Nyasaland.
VP-PAA—VP-PZZ Islands under the rule of the Western Pacific High Commission.
VP-RAA—VP-RZZ Northern Rhodesia.
VP-SAA—VP-SZZ Protectorate of Somaliland.
VP-TAA—VP-TZZ Trinidad and Tobago.
VP-UAA—VP-UZZ Protectorate of Uganda.
VP-VAA—VP-VZZ St. Vincent.
VP-XAA—VP-XZZ Colonies and Protectorate of Gambia
VP-YAA—VP-YZZ Southern Rhodesia.
VP-ZAA—VP-ZZZ Protectorate of Zanzibar.
VQ-BAA—VQ-BZZ Barbados.
VQ-CAA—VQ-CZZ Cyprus.
VQ-FAA—VQ-FZZ Fiji Islands.
VQ-GAA—VQ-GZZ Grenada.
VQ-HAA—VQ-HZZ St. Helena.
VQ-LAA—VQ-LZZ St. Lucia.
VQ-MAA—VQ-MZZ Mauritius.
VQ-PAA—VQ-PZZ Palestine.
VQ-SAA—VQ-SZZ Seychelle Islands.
VR-BAA—VR-BZZ Bermuda.
VR-GAA—VR-GZZ Gibraltar.
VR-HAA—VR-HZZ Hong Kong.
VR-JAA—VR-JZZ Johore.
VR-LAA—VR-LZZ Colonies and Protectorate of Sierra Leone.
VR-NAA—VR-NZZ Colonies and Protectorate of Nigeria, including British Cameroons.
VR-RAA—VR-RZZ Federated Malay States.
VR-SAA—VR-SZZ Straits Settlements.
VR-TAA—VR-TZZ Tanganyika.
VR-UAA—VR-UZZ State of Brunei (British North Borneo).

VT- India.
XA- or **XB-** Mexico.
XH- Honduras.
XT- China.
XY- Burma.
YA- Afghanistan.
YI- Iraq.
YJ- New Hebrides Condominium.
YR- Rumania.
YS- El Salvador.
YU- Yugoslavia.
YV- Venezuela.
ZA- Albania.
ZK- New Zealand.
ZP- Paraguay.
ZS- Union of South Africa.

**U.S.A.—The letter N is followed either by the letter X for civil aircraft with an experimental licence, the letter C for civil aircraft with an Approved Type Certificate, the letter R for aircraft of restricted use, such as racers, crop-dusters or others with special modifications, or S for State-owned aircraft, such as those belonging to Government or State departments or bureaux. The two letters are followed by a registration number.*

INTERNATIONAL ORGANIZATIONS

THE INTERNATIONAL CIVIL AVIATION ORGANIZATION (I.C.A.O.)

THE COUNCIL

HEADQUARTERS: Dominion Square Buildings, Montreal, Canada.

President: Dr. Edward P. Warner (U.S.A.).

Vice-Presidents: Dr. F. H. Copes Van Hasselt (Netherlands); Col. C. Y. Liu (China); and G. E. Sauroz (Columbia).

Secretary-General: Dr. Albert Roper (France).

Member States: Australia, Belgium, Brazil, Canada, Chile, China, Columbia, Czechoslovakia, Egypt, El Salvador, France, India, Iraq, Mexico, the Netherlands, Norway, Peru, Turkey, United Kingdom, and United States. A seat on the Council has been reserved for Russia.

A Provisional International Civil Aviation Organization was established when the Interim Agreement on International Civil Aviation came into force on June 6, 1945, after 30 nations had announced their formal acceptance of the Agreement. The Organization was established for an interim period to last until a new permanent convention on international civil aviation shall have come into force.

The International Civil Aviation Organization, successor to the Provisional International Civil Aviation Organization (P.I.C.A.O.), came into being on April 4, 1947, following the ratification of the Permanent Convention by the required number of States.

The Organization consists of an Assembly and a Council.

The Assembly

To meet annually and be convened by the Council. Extraordinary meetings of the Assembly may be held at any time when called by the Council or at the request of any ten member States. All member States have equal right to be represented at the meetings of the Assembly and each member is entitled to one vote. The powers and duties of the Assembly are: (*a*) to elect at each meeting its president and officers; (*b*) to elect the member States to be represented on the Council; (*c*) to examine and take action upon the reports of the Council; (*d*) to determine its own rules of procedure and establish such subsidiary commissions and committees as are needed; approve an annual budget and determine the financial arrangements of the Organization; (*e*) to refer any specific matters to the Council; (*f*) to delegate the necessary powers and authority to the Council which are needed for the duties of the organization; and (*g*) to deal with any matters not specifically assigned to the Council.

The Council

The Council to be composed of not more that 21 member States elected by the Assembly for a period of two years, adequate representation to be given to: (1) those member States of chief importance in air transport; (2) those member States not otherwise included which make the largest contribution to the provision of facilities for international civil air navigation; (3) those member States not otherwise included whose election will ensure that all major geographical areas of the World are represented. No representative of a member State on the Council may be actively associated with or financially interested with the operation of an international air service.

The Council shall elect a President, who will have no vote. One or more vice-presidents to be elected from among the members, who will retain the right to vote when serving as acting president. Decisions of the Council to be deemed valid when approved by a majority of all members. Any member State not a member of the Council may participate in deliberations whenever any decision is to be taken which especially concerns such a member State. But such a State may not vote. In any case in which there is a dispute between one or more member States not members of the Council and one or more member States who are members of the Council, any State within the second category which is party to the dispute shall have no right to vote on that dispute.

The duties and powers of the Council are:—

(1) to discharge the directives of the Assembly.

(2) to determine its own organization of the Assembly.

(3) to determine the method of appointment, emoluments and conditions of service of the employees of the organization.

(4) to appoint a Secretary-General.

(5) to provide for the establishment of any subsidiary working groups which may be considered desirable, including the following interim Committees:—

(*a*) A Committee on Air Transport.

(*b*) A Committee on Air Navigation.

(*c*) A Committee on International Convention on Civil Aviation.

(6) to prepare and submit to the Assembly budget estimates of the Organization and statements of accounts of all reports and expenditures.

(7) to enter into agreements with other international bodies when deemed advisable for the maintenance of common service and for common arrangements concerning personnel and, with the approval of the Assembly, enter into such other arrangements as may facilitate the work of the Organization.

In addition, the functions of the Council are to maintain liaison with the member States, calling on them for such data and information as may be required; receive, register and hold open to inspection by member States, all existing contracts and agreements covering routes, services, landing rights, airport facilities, or other international air matters to which any member State or its airlines is a party; supervise and co-ordinate the works of the three Committees, consider their reports and transmit the Committee's reports and the findings of the Council to the member States. In addition, the Council is to make recommendations on technical matters to the member States of the Assembly, submit an annual report to the Assembly and, on the direction of the Assembly, convene another conference on international civil aviation or, at such time as the Convention is ratified, convene the first Assembly under the Convention. When requested by all the parties concerned, the Council will act as an arbitral body on any difference arising among member States relating to international civil aviation matters which may be submitted to it.

The expenses of the Provisional Organisation are borne by the member States in proportions to be decided by the Assembly and funds are to be advanced by member States to cover the initial expenses of the Organization. Each member State bears the expenses of its own delegation to the Assembly and those of its delegates on the Council and its representatives on committees or subsidiary groups.

Each contracting State undertakes that its international airlines shall file traffic reports, cost statistics and financial states with the Council. Each contracting State may designate the route to be followed within its territory by any international air service, and the airports which any such service may use. If the Council is of the opinion that the airports or other navigation facilities of a contracting State are not reasonably adequate the Council may consult with the State and others affected, to find means of correcting the position and may make recommendations. If requested by the State, the Council may provide all or a portion of the costs needed for the remedies.

A contracting State may at any time discharge any obligation into which it has entered and take over airports and other facilities which the Council has established in its territory by paying to the Council an amount considered reasonable.

The Council may suggest to contracting States that they form joint organizations to operate air services on any routes or in any regions.

The duties of the Committees established under the Council shall be:—

The Committee on Air Transport: To observe, correlate and continuously report on facts concerning the origin and volume of international air traffic and the relation of such traffic, or the demand for it, to the facilities provided; collect, analyse and report on subsidies, tariffs and costs of operation; study matters affecting the organization and operation of international air services, including the international ownership and operation of international trunk lines; and study and report, with recommendations to the Assembly as soon as practicable on matters on which agreement was not reached at the Chicago International Civil Aviation Conference.

The Committee on Air Navigation: Study and advise on standards and procedures for communications systems and air navigation aids including rules of the air, traffic control practices, licensing of operating and mechanical personnel, airworthiness, registration and identification of aircraft, meteorological protection of international aeronautics, log books, maps and charts, airports, customs, accident investigation and so forth. In addition the Committee will work towards the adoption of minimum requirements and standard procedures for all the above and continue the preparation of technical documents in accordance with the recommendations of the Chicago Conference.

THE INTERNATIONAL AIR TRAFFIC ASSOCIATION (I.A.T.A.)

HEADQUARTERS: Central Station Building, Montreal, Canada.

BRANCH OFFICES: Cairo, Rio de Janeiro and New York.

President: H. J. Symington, C.M.G. (Canada).

President Elect: Hafez Afifi Pasha (Egypt).

Director-General: Sir William Hildred (England).

Executive Committee: John E. Slater (U.S.A.) (Chairman), J. R. McCrindle (England), René Briand (France), Per A. Norlin (Norway), A. F. T. Cambridge (India), Albert Plesman (Netherlands), J. Benito Ribeiro Dantas (Brazil), Hassan Sadek Pasha (Egypt), W. Hudson Fysh (Australia), T. H. Shen (China) and T. B. Wilson (U.S.A.).

Traffic Committee. Chairman: C. A. Rheinstrom (U.S.A.).

Financial Committee. Chairman: G. Temple Meller (G.B.).

Legal Committee. Chairman: John C. Cooper (U.S.A.).

Technical Committee. Chairman: A. C. Campbell Orde (G.B.).

THE INTERNATIONAL AIR TRAFFIC ASSOCIATION—*continued.*

The International Air Transport Association was formally inaugurated on April 19, 1945, at Havana, following a conference of international airline operators. Invitations to the conference and plans for the new organization were drawn up at a conference held in Chicago in December, 1944, on the initiative of the American Air Transport Association and attended by 34 representatives of 21 nations. The new Association succeeds the original International Air Traffic Association founded in 1919.

Headquarters of the new I.A.T.A. are at Montreal, Canada, and the association consists of a General Assembly, comprising 60 air transport companies, and an Executive Committee, in which is vested the management of the association. The post of President is an honorary position.

The aims and objects of I.A.T.A. are to promote safe, regular and economical air transport; to foster the development of air commerce, and to study all problems connected therewith; to provide efficient machinery for collaboration among all air transport operators who are engaged directly or indirectly in international air transport service; and to co-operate with the Internation Civil Aviation Organization (P.I.C.A.O.) and other international bodies.

There are two categories of membership—Active and Associate. Any air transport undertaking is eligible for active membership if it operates a scheduled air service under proper authority for passengers, mail or cargo, between the territories of two or more States, under the flag of a State eligible for membership in the International Civil Aviation Organization.

The Active Members are:—A.B. Aerotransport (Sweden); Aer Lingus Teoranta (Eire); Aero Portuguesa (Portugal); Air France; All-India (Tata); American Airlines, Inc.; American Overseas Airlines; Braniff Airways; British Overseas Airways Corporation; British West Indian Airways; Ceskoslovensko Aerolinie; China National Aviation Corporation; Cia Mexicana de Aviacion; Colonial Airlines; Det Danske Luftfartselskab; Det Norske Luftfartselskap; Empresa de Viacaõ Aerea Rio Grandense, Expreso Aereo Inter-Americano; Indian National Airways; K.L.M.; K.N.I.L.M.; Linea Aeropostal Venezolana; Lineas Aereas Iberia; Misr Airwork (Egypt); Northeast Airlines; Northwest Airlines; Panair do Brasil; Pan American Airways; Pan American-Grace Airways; Polskie Linic Lotnicce; Qantas Empire Airways; Servicios Aereos Cruzeiro do Sul; Sabena; South African Airways; Svensk Inter-Kontinental Lufttrafik; Swissair; T.A.C.A. (El Salvador); Tasman Empire Airways; Trans-Canada Air Lines; Trans-continental and Western Air, Inc.; United Air Lines; Western Air Lines; and Wrightways, Ltd.

Associate membership may be obtained by any air transport concern operating an authorised scheduled air service under the flag of a State eligible for membership in the International Civil Aviation Organization. The Associate Member companies are:—Aerovias Nacionales do Colombia; Alaska Airlines; All-American Aviation; Allied Airways (Gander Dower) Ltd.; Australian National Airways; Compania Cubana de Aviacion; Companhia de Transportes Aereos (Portugal); Delta Air Lines; Eastern Airlines; Linea Aerea Nacional (Chile); National Airlines; Pennsylvania-Central Airlines; and Portsmouth Aviation, Ltd.

I.A.T.A. has four standing committees:—financial, legal, technical and traffic, each being divided into working committees and sub-committees as necessary.

The Financial Committee concerns itself with all financial matters connected with air transport: standardization of methods of rendering, verifying and settling accounts for revenue transactions as between members; clearinghouse problems; insurance questions; introduction and control of international monetary documents, *e.g.* travellers' cheques and letters of credit, and statistical matters.

The Legal Committee deals generally with legal matters having a bearing on international air transport, particularly with international conventions on public and private air law, and on other means of transport: conflicts of law and arbitration.

The Technical Committee, ranging over the whole field of international air transport technicalities, handles operational matters, the promotion of safety and efficiency in flight, standardization of equipment, wireless, meteorology, maintenance of aircraft, airports and airport procedure.

The Traffic Committee concerns itself with all international air traffic matters, involving passengers, cargo and the handling of mail. It studies in particular the principles involved in fixing tariffs, rates and schedules, general conditions of carriage, traffic forms, documents and procedures, reservation codes and procedures, government forms, regulations and procedures, ethics of advertising and publicity, and all matters pertaining to agents.

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE (F.A.I.)

HEAD OFFICE: 6, RUE GALILÉE, PARIS, FRANCE.

President: Lord Brabazon of Tara, P.C., M.C.

Vice-Presidents: Jonkheer van den Berch van Heemstede (Netherlands), General B. J. Kwiecinski (Poland), S. E. Mohamed Taher Pasha (Egypt), The Marquess of Londonderry (Great Britain), Bay Sucru Kocak (Turkey), Colonel W. N. Gerber (Switzerland), G. A. de Ro (Belgium), Baron de la Grange (France).

Secretary-General: Felix Camerman.

Treasurer-General: E. Blondel La Rougerie.

The *Fédération Aéronautique Internationale* was founded in Paris, in October, 1905. The countries represented at its foundation were Belgium, France, Germany, Great Britain, Italy, Spain Switzerland, and the United States of America. The aim was co-operation between nations concerning aeronautics and with the development of aviation the F.A.I. has become the international representative body of world aviation. The first record to be officially homologated by the F.A.I. was a speed record of 41.29 km.h. (25.06 m.p.h.) set up on November 12, 1906 by Alberto Santos Dumont. He was timed over a distance of 220 metres (721 feet), which was as far as he could then fly.

Between the two wars many international arrangements were made under the supervision of the F.A.I. and international rules and sports codes for private flying were drawn up. For example, most of the countries who were represented on the F.A.I. through their accredited national Aero Club, agreed to recognise the *Carnet de passage en Douane* making private flying between countries easier. Landing facilities and international sport and touring licences were introduced. The F.A.I. also played an important *rôle* in the development of gliding and soaring.

All World or International Records must be observed by a representative of a national Aero Club affiliated to the F.A.I. before such a record is "homologated" or approved by the F.A.I.

The F.A.I. sits annually in general conference, but its various commissions sit more often. The last conference was held in London in September, 1946.

The following is the list of national aero clubs which are affiliated to the F.A.I. (correct to December 31, 1946):—

Tho Royal Aero Club of the United Kingdom, 119, Piccadilly, London.

Aero Club of South Africa, P.O. Box 8550, Johannesburg, South Africa.

Aero Club Argentino, Rodriguez Pena, 240, Buenos Aires, Argentina.

Aéro Club Royale de Belgique, 11 Boulevard de Regent, Brussels, Belgium.

Aero Club do Brasil, 31 rua Alvaro Alvin, Rio de Janeiro, Brazil.

Royal Canadian Flying Clubs Association, 309, Journal Building, Ottawa, Canada.

Club Aéreo de Chile, Santa Lucia 256, Santiago, Chile.

Club de Aviación de Cuba, Edificio Larrea, Havana, Cuba.

Det Kongelige Danske Aeronautiske Selskab, Norre Farimagsgade 3K, Copenhagen, Denmark.

The Royal Aero Club of Egypt, 26 rue Sherif Pasha, Cairo, Egypt.

Federación Aeronáutica Nacional de España, Calle Mayor No. 4, Madrid, Spain.

National Aeronautic Association of U.S.A., 1025, Connecticut Avenue, Washington, D.C., U.S.A.

Aéro Club de France, 6, Rue Galilée, Paris XVIe, France.

Flugmalafelag Islands, P.O. Box 234, Reykjavik, Iceland.

Irish Aviation Club, Abbey Building, Middle Abbey Street, Dublin, Eire.

Aéro Club du Grand Duche du Luxembourg, 5, Avenue Monteray, Luxembourg.

Norsk Aero Klubb, Ovre Slottsgate 20, Oslo, Norway.

Koninklijke Nederlandsche Vereeniging voor Luchtvaart, 3, Anna Paulownaplein, The Hague, Netherlands.

Aero Club del Peru, Lima.

Aeroklub Polskiej, ul. Chaubinskiego, 4, Warsaw, Poland.

Aero Club de Portugal, Avenida da Liberdad 226, Lisbon, Portugal.

Kungl. Svenska Aeroklubben, Malmskillnadsgaten 27, Stockholm, Sweden.

Aéro Club de Suisse, Hirschengraben 22, Zurich, Switzerland.

Aeroklub Republiky Cezkoslovenske, Smecky 22, Prague, Czechoslovakia.

Turk Hava Kurumu, Enstitu, Caddesi 1, Ankara, Turkey.

Aero Club Central de L'U.S.S.R., Moscow, Touchino, U.S.S.R.

The Associated Australian Aero Clubs have intimated a desire to join and will be admitted in 1947.

The following were formerly members but are temporarily suspended:—

Aero Club di Bulgaria, Sofia, Bulgaria.

Magyar Aero Szövetség, Budapest, Hungary.

Aero Club d'Italia, via Cesare Beccaria 35, Rome, Italy.

Aoro Clubul Regal al Romaniel, B-dul Lascar Catargi 54, Bucarest, Rumania.

Suomen Ilmailulitto Flyforbund R.Y., Mannerheimintie 16, Helsinki, Finland.

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE—*continued.*

National Aero Clubs, formerly members of the F.A.I., about which the Federation has at present no information :—
Eesti Aeroklubi, Tallinn, Estonia.
Latvijas Aeroklubs, Riga, Latvia.
Lietuvos Aero Klubas, Kaunas, Lithuania.
Naša Krila, Belgrade, Yugoslavia.
Aero-Club de Grece, Athens, Greece.

The Aero Clubs of Germany and Japan are considered to have ceased to exist.

OFFICIAL WORLD RECORDS.

Recognised by the Fédération Aéronautique Internationale.

(Correct to December 31, 1946).

The following represent the principal World's Records which are recognised by the F.A.I.

ABSOLUTE RECORD BY ANY TYPE OF AIRCRAFT, INCLUDING BALLOONS.

Distance in straight Line (U.S.A.).
Commander Davies, U.S.N. and crew of three in Lockheed P2V-1 Neptune. Perth, Western Australia, to Columbus, Ohio, U.S.A. 18,105 km. (11,243.2 miles). September 29-October 1, 1946.

Distance in Closed Circuit (Italy).
Lieut. Col. A. Tondi and crew of two. Rome. July 30-August 1, 1939. 12,935.770 km. (8,034.1 miles).

Height (U.S.A.).
Capt. A. Stevens and Capt. O. A. Anderson in a balloon. November 11, 1935. 22,066 m. (72,376.5 ft.).

Speed in Straight Line (Great Britain).
Group. Capt. E. M. Donaldson, D.S.O., A.F.C., R.A.F. in a Gloster Meteor (two Rolls-Royce Derwent V gas-turbine units). Littlehampton. September 7, 1946. 991 km.h. (616 m.p.h.).

OTHER RECORDS.

CLASS A—BALLOONS.

Duration (Germany).
H. Klauen. December 13-17, 1913. 87 hours.

Distance (Germany).
—. Berliner. February 8-10, 1914. 3,052.7 km. (1,895.7 miles).

CLASS B—AIRSHIPS.

Distance (Germany).
Dr. Hugo Eckener in *Graf Zeppelin.* Lakehurst, U.S.A. to Friedrichshafen, Germany. October 29-November 1, 1928. 6,384.5 km. (3,970.77 miles).

CLASS C—AEROPLANES.

Distance in Straight Line (U.S.A.).
As for Absolute Record—see above.

Speed in Straight Line (Great Britain).
As for Absolute Record—see above.

Height (Italy).
Lieut. Col. Mario Pezzi in a Caproni Ca. 161*bis.* October 22, 1938. 17,083 m. (56,032.2 ft.).

CLASS C*bis*—SEAPLANES.

Distance (Great Britain).
Capt. (now Air Vice-Marshal) D. C. T. Bennett and 1st Officer I. Harvey in Short Mercury seaplane (composite launch). Dundee, Scotland, to Port Nolloth, South Africa. October 6-8, 1938. 9,652 km. (5,993.38 miles).

Distance in Closed Circuit (Italy).
Mario Stoppani and Carlo Tonini in a Cant. Z.506 seaplane. May 27-28, 1937. 5,200 km. (3,229.2 miles).

Speed in a Straight Line (Italy.)
Lieut. F. Agello in a Macchi-Castoldi 72 seaplane. October 23, 1934. 709.209 km.h. (440.675 m.p.h.).

Height (Italy).
Colonel N. di Mauro in a Caproni Ca. 161 seaplane. September 25, 1939. 13,542 m. (44,417.7 ft.).

CLASS G—HELICOPTERS.

Duration with return to starting point (U.S.A.).
Major D. H. Jensen and Major W. C. Dodds in a Sikorsky R-5A. Dayton, Ohio. November 14, 1946. 9 hours 57 minutes.

Distant in Closed Circuit (U.S.A.).
Major D. H. Jensen and Major W. C. Dodds in a Sikorsky R-5A. Dayton, Ohio. November 14, 1946. 1,000 km. (621 miles).

Distance in Straight Line (U.S.A.).
Major F. T. Cashman and Major W. E. Zins in a Sikorsky R-5A. Dayton, Ohio, to Boston, Mass. May 22, 1946. 1,132.337 km. (703.2 miles).

Speed (over 20 km.). (Germany).
Ewald Rohlfs in a Focke Fw. 161. Bremen. June 26, 1937. 122.533 km.h. (76 m.p.h.).

Height (U.S.A.).
Major E. M. Cassell in a Sikorsky R-5A. Patterson Field, Ohio. February 10, 1947. 5,591 m. (18,340 ft.).

POINT-TO-POINT SPEED RECORDS.

The F.A.I. now recognises a limited number of point-to-point speed records, several of which are allocated to each country. The following are the only such records which have been homologated since the end of the War.

London-Karachi, India (Great Britain).
Air Cdre. N. D'Aeth, Sq. Ldr. J. S. Aldridge, Flt. Lt. D. D. Hurditch and crew in Avro Lancaster *Aries.* August 21-22, 1946. 6,350 km. (3,943.5 miles) in 19 hrs. 14 min.=330.15 km.h. (205 m.p.h.).

London-Darwin, West Australia (Great Britain).
Same aircraft and crew as for London-Karachi. August 21-23, 1946. 13,903.26 km. (8,633.92 miles) in 45 hrs. 25 min.= 305 km.h. (189.4 m.p.h.).

London-Wellington, New Zealand (Great Britain).
Same aircraft and crew as for London-Karachi. August 21-24, 1946. 18,744.423 km. (11,640.28 miles) in 59 hrs. 50 min.= 313.27 km.h. (194.54 m.p.h.).

INTERNATIONAL GLIDING RECORDS.

Distance (U.S.S.R.).
Miss O. Klepikova in *Red Front* 7 single-seat sailplane. Moscow-Stalingrad. July 6, 1939. 749.203 km. (465.2 miles).

Out and Return (U.S.S.R.).
Boris Kimelman in *Red Front* 7 single-seat sailplane. Toula-Riajsk-Toula. July 23, 1939. 342.37 km. (212.6 miles).

Height (Germany).
E. Ziller in Kranlich sailplane. Hirchberg. November 21, 1938. 6,838 m. (22,428.6 ft.).

Duration (Germany).
August Boedecker and Karl Zander in Kranlich sailplane. Rositten. September 9-11, 1938. 50 hrs. 26 min.

(*Note* :—A record of 55 hours 52 minutes was set up on September 23-24, 1943, in Germany by Ernst Jachtmann, but in 1945 the F.A.I. decided not to recognise records set up during the War).

ARGENTINA

(The Argentine Republic—República Argentina)

ADMINISTRATION

In 1946 the Aeronautical Department was separated from the Ministry of War and elevated to the status of a separate Ministry. Brigadier General Bartoleme de la Colina, formerly Director General of Aeronautics becomes the first Air Minister in the Cabinet of President Juan. D. Peron.

The controlling authority of civil aviation is the Director-General of Civil Aeronautics (Dirección-General de Aeronáutica Civil), who is directly responsible to the Air Minister. Director-General of Civil Aviation: Brigadier Juan L. Garramendi. Officer: Avenida Quintana 591, Buenos Aires.

Subordinate to the Dirección-General de Aeronáutica Civil are:—

Dirección de Aeronáutica Comercial, (Directorate of Commercial Flying).

Dirección de Aeronáutica Deportiva, (Directorate of Private Flying).

ASSOCIATIONS

Aero-Club Buenos Aires, Calle Rodriguez Peña 240, Buenos Aires. Affiliated to the *Fédération Aéronautique Internationale* (*F.A.I.*). President: Arturo D. Vatteone. Secretary: Jorge Glenny.

Comite Argentino Permanente de Aéronautica, Avenida Roque Saenz Peña 615, Buenos Aires.

PUBLICATIONS

Avia. Monthly. Published by the Revista Argentina de Aeronáutica, Victoria 788, Buenos Aires. Editor: Miquel Angel Maccor.

Ejercito y Armada. Monthly. Published at Avenida Roque Saenz Peña 501, Buenos Aires.

Mundo Aeronáutico. Monthly. Published at Rivadavia 945-949, Buenos Aires. Editor: Francisco Corteyoso.

Rutas del Aire. Monthly. Published at Melincue 2501, Buenos Aires. Editor: Salvador Impellizeri.

Aeronave. Monthly. Published at 825, Avenida Roque Saenz Peña, Buenos Aires.

NATIONAL TRANSPORT COMPANIES

Lineas Aéreas del Estado (L.A.D.E.).

Head Office: Corrientes 480, Buenos Aires.

The Government-owned company which is authorised to negotiate agreements and initiate operations for the Flota Aerea Mercante Argentina (F.A.M.A.). The decree establishing F.A.M.A. also placed the Lineas Aereas del Estado under the jurisdiction of the Dirección de Aeronautica Civil.

Formerly this organization was under the administrative control of the military authorities. It was a consolidation of the military air mail services operated by the Linea Aerea Sudoeste (L.A.S.E.) and the Linea Aerea Noreste (L.A.N.E.), inaugurated in 1940 to serve areas ill-supplied with communiciations and to provide training and practice in navigation and cross-country flying for military flying personnel. Domestic air routes are now to be operated by three corporations formed at the instigation of the State and to be partly State and partly privately owned.

Flota Aérea Mercante Argentina (F.A.M.A.).

Head Office: Corrientes 480-84, Buenos Aires.

This corporation has been established to serve as the accepted "chosen instrument" for all international air services. It has a capital of A. Pesos 150,000,000, of which one-third is held by the State. It will enjoy exclusive reciprocity rights derived from all international agreements.

Equipment: Short Sunderland (Dodero-owned), Avro York and Vickers Viking. Three Avro Tudor II on order.

Compañia Argentina de Aeronavegación Dodero S.A. (Dodero).

Head Office: Carrento 389, Buenos Aires.

This company was formed in 1945 by the Dodero shipping interests to establish air services between Argentina and the neighbouring countries and Europe. It acquired complete control of the Corporacion Sudamericana de Servicios Aeros in May, 1946. The company has met with many setbacks and the creation of the State-inspired F.A.M.A. corporation makes it seem unlikely that it will be permitted to conduct international airline services under the Argentine flag.

In the meantime, the company has formed a subsidiary to operate domestic services. (See A.L.F.A.).

Sociedad Mixta Aviación Litoral Fluvial Argentino (A.L.F.A.).

Head Office: Buenos Aires.

This concern is a newly-formed subsidiary, with both private and State capital, of the Dodero company to operate domestic air services. It has received a charter from the Argentine Government to take over the domestic services previously operated by the Lineas Aereas del Estado (L.A.D.E.).

Soziedad Mixta Zonas Oeste y Norte de Aerolineas Argentinas (Z.O.N.D.A.).

Head Office: Buenos Aires.

Established in September, 1946, as one of the three corporations to be formed at the instigation of the State to operate domestic services in Argentina. It has a capital of A. Pesos 10,000,000, of which 20% is held by the Government. This concern will serve the North and Western areas of the republic.

Equipment: 15 Douglas C-47 (10 passenger, 5 cargo).

Sociedad Mixta Aeroposta Argentina.

Head Office: Avenida de Mayo 560, Buenos Aires.

This airline, started in 1931 under the guidance of the French Aeropostale Company, is now an Argentine concern of joint State and private ownership. Its operations are confined to the Southern area of the republic, with headquarters at "General Pacheco" Airport, Buenos Aires.

Taxi Aero Argentino S.A. (T.A.A.S.A.).

The formation of this company has been authorised by the Civil Aviation Department for the operation of air taxi, ambulance and other non-scheduled services within the republic.

INTERNATIONAL TRANSPORT COMPANIES

The following international air-carriers operate services to and through Argentina:—

Compania Aeronautica Uruguaya S.A. (Uruguay).
Pan American Airways (U.S.A.).
Pan American-Grace Airways (U.S.A.).
Servicios Aereos Cruiziero do Sul, Ltda. (Brazil).
Linea Aerea Nacional (Chile).
British South American Airways Corpn. (U.K.).

FLYING SCHOOLS

A National School of Aeronautics gives ground instruction and flying courses, while the Argentine Weather Bureau is organizing a service of upper air weather observations, using military aircraft and pilots.

The Universities of Buenos Aires and Córdoba have added a seat of Aeronautical Engineering to their curricula.

FLYING CLUBS

State aid for flying clubs (financial and material, in the shape of aircraft) is contingent on compliance with strict regulations, the principal of which are the obligation to maintain a school for training pilots, to facilitate the training of as many pilots as possible, to maintain stocks of aircraft fuel and lubricants for machines in transit, and to provide instruction in aeronautics. Aviation material is exempt from customs duty.

The Government sponsors a programme to develop private flying. The Government bear the flying costs based on actual hours flown and pays the salaries of instructors. The flying clubs pay for maintenance and repair of the aircraft.

AIRPORTS

With Customs facilities without time limit.

Buenos Aires (Seis de Setembre or Presidente Rivadavia). Lat. 34°40′S., 58°39′W. Altitude above mean sea level, 60 ft. Runway N.N.W./S.S.E. 1,535 yds. × 43 yds.

Jujuy (Alto del Comodero). Lat. 24°14′S., Long. 65°15′W., Altitude above mean sea level 4,139 ft.

Mendoza (Los Tamarindos). Lat. 32°50′S., Long. 68°47′W. Altitude above mean sea level 2,476 ft.

Monte Caseros. Province of Corrientes. Lat. 30°16′S., Long. 48°47′W. Altitude above mean sea level 161 ft.

Resistencia. Province of Chaco. Lat. 27°29′S., 59°0′W. Altitude 167 ft.

Salta (General Manuel Belgrano). Lat. 24°36′S., Long. 65° 25′W. Altitude 3,848 ft.

For complete details regarding existing aerodromes in Argentina, reference should be made to *Guia Aeronautica de Aeropistas*, issued from Avenida Roque Saenz Peña 615 (Edificio Bencich), Buenos Aires.

BELGIUM

(The Kingdom of the Belgians—Royaume de Belgique)

ADMINISTRATION

The administration of civil aviation in Belgium is the responsibility of the following department:—

L'Administration de l'Aéronautique.

Address: 90, Rue de la Loi, Brussels.

Director: M. E. Crabbe.

Responsible for the regulation and supervision of air navigation, as well as the agreements arrived at with foreign

BELGIUM—*continued.*

countries, and for the encouragement of the national aircraft industry, aeronautical science and aircraft construction. It is assisted by the :—

Service Technique de l'Aéronautique.
Address : 53, Boulevard du Régent, Brussels.
Director : M. l'Ingénieur Florine.

ASSOCIATIONS

Comité National d'Aéronautique. 53, Avenue des Arts, Brussels. Entrusted with the co-ordination of all private and non-commercial flying activities.

Aéro-Club Royal de Belgique. 48, Avenue des Arts, Brussels. Founded 1901. Affiliated to the *Féderation Aéronautique Internationale* (*F.A.I.*).

Fédération des Clubs d'Aviation de Tourisme. 11, Place Léopold, Antwerp.

PUBLICATIONS

La Conquête de l'Air. Founded in 1904 by the late M. Adhemar de la Hault. Published monthly at 13, Rue de la Bréderode, Brussels.

L'Echo des Ailes. Published fortnightly at 83, Marché St. Jacques, Antwerp.

Aéronef-Luchtvaart-tuig. Published quarterly at 33, Rue Masseaux, Brussels.

Pilote. Published monthly at 37, Rue des Cygnes, Brussels.

Les Ailes Belges. Published monthly at 26, Avenue de la Liberté, Brussels.

L'Aviation. Published monthly at 300, Avenue d'Auderghem, Brussels.

NATIONAL TRANSPORT COMPANY

Société Anonyme Belge d'Exploitation de la Navigation Aérienne (S.A.B.E.N.A.).
Head Office : 145, Rue Royale, Brussels.
Belgian air transport is in the hands of S.A.B.E.N.A. which was incorporated in 1923 and is owned jointly by the Belgian Government, the Belgian Congo Colonial Government, and the principal Belgian banks.
Equipment :—Douglas DC-4, Douglas DC-3, Douglas C-47, Lockheed Lodestar, Lockheed 14 and 18, Junkers Ju 52. (Douglas DC-6 and DH Dove on order).

INTERNATIONAL TRANSPORT COMPANIES

(Operating routes to and through Belgium).

A.B. Aerotransport (Sweden).
Air-France (France).
British European Airways Corporation (U.K.).
Ceskoslovenske Aerolinie (Czechoslovakia).
Pan American World Airways (U.S.A.).

AIRPORTS

BRUSSELS (Haren). Lat 50°53'N., Long 04°25'E., Altitude 197 ft. Customs Airport with all facilities (radio, sheds, lighthouse, meteorological station, etc.). One concrete runway 1,000 m. long, one emergency perforated steel sheet runway 1,050 m. long. Aerodrome open for commercial traffic round the clock, for tourist traffic from sunrise to sunset.

BRUSSELS (Melsbroek). Civil airport open to heavy cargo aircraft by day only. No customs. Three concrete runways 1,650, 1,600 and 1,800 m. long respectively.

LE ZOUTE (Knocke). Lat. 51°21' N., Long. 03°21'E., Altitude 10 ft. Civil aerodrome with customs facilities for passengers only. Two runways, both 1,100 m. long.

GOSSELIES (Charleroi). Civil aerodrome. One runway 1,100 m. long.

ST. DENIS WESTREM (Ghent). Civil aerodrome. One runway 1,000 m. long.

THE BELGIAN CONGO

ADMINISTRATION

By order of the Governor-General, dated December 27, 1939, an Aeronautical Service was created within the Service of Public Works of the Government to administer all matters concerning aviation in the colony.

NATIONAL TRANSPORT COMPANY

Société Anonyme Belge d'Exploitation de la Navigation Aérienne (S.A.B.E.N.A.).

FOREIGN TRANSPORT COMPANIES

The following international air-carriers operate routes to and through the Belgian Congo.
Air France (France).
D.E.T.A. (Portuguese West Africa).
Pan American World Airways (U.S.A.).

CUSTOMS AIRPORTS

BANNINGVILLE (Prov. Léopoldville) :—Civil Customs Aerodrome. Wireless, hangar, repairs, petrol, sanitary service.

BOMA (Prov. Léopoldville) :—Civil Customs Aerodrome. Petrol hangar, repairs, sanitary service.

LÉOPOLDVILLE (Prov. Léopoldville) :—Civil Customs Aerodrome. Wireless, hangers, repairs, meteorological station, sanitary service.

COQUILHATVILLE (Prov. Coquilhatville) :—Civil Customs Aerodrome. Hangar, wireless, repairs, petrol, meteorological station, sanitary service.

LIBENGE (Prov. Coquilhatville) :—Civil Customs Aerodrome. Hangar, wireless, petrol, repairs, sanitary service.

STANLEYVILLE (Prov. Stanleyville) :—Civil Customs Aerodrome Hangar, wireless, repairs, sanitary service.

ELISABETHVILLE (Prov. Elisabethville) :—Civil Customs Aerodrome. Hangar, repairs, petrol, meteorological station, sanitary service. Manager : Jose de la Reza.

BOLIVIA

(The Bolivian Republic—República Boliviana)

ADMINISTRATION

Civil Aviation in Bolivia is under the jurisdiction of the Ministry of Defence.
Director General of Aeronautics : Colonel Jorge Jordan.

ASSOCIATION

Club Aero Boliviano. La Paz. President : Juan Pando.

NATIONAL TRANSPORT COMPANY

Lloyd Aéreo Boliviano (L.A.B.).
Head Office : Casilla 132, Cochabamba.
President : Ing. Frederico A. Rocha.
This airline, which began operations in 1926, was largely fostered by German aviation interests, chiefly the Deutsch Lufthansa. On May 14, 1941, the company was expropriated by the Bolivian Government. In order to improve the operations of the company an agreement was concluded on June 9, 1941, whereby Pan American-Grace Airways loaned personnel for instruction purposes, etc. The Government continues to subsidize the company by monthly payments of 16,000 Bolivians (13,333 Bol.=£1 at par).
Equipment :—Lockheed Lodestars.

INTERNATIONAL TRANSPORT COMPANY

The following international air-carrier operates routes to and through Bolivia :—
Pan American-Grace Airways Inc. (Panagra).

AERODROMES

The principal aerodromes in Bolivia are :—AIQUILE, APOLO, CACHUELA ESPERANZA, CAÑADA LARGA, CHARAGUA, CHORETI, COBIJA, COCHABAMBA, COMARAPA, CONCEPCION, GUAYARAMERIN, IPIAS, JOROCHITO, LAJAS, LA PAZ, MAGDALENA, MIZQUE, MOTACUSITO, ORURO, POZO DEL TIGRE, PULQUINA, PUERTO SUAREZ, RIBERALTA, ROBORÉ, SAN BORJA, SAN IGNACIO, SAN JAVIER, SAN JOSÉ, SAN LORENZO, SANTA ANA, SANTA CRUZ, SUCRE, TARIJA, TODOS SANTOS, TRINIDAD, TRES CRUCES, UYUNI, VALLE ABAJO, VALLE GRANDE, VILLA MONTES, VILLAZON, YACUIBA.

BRAZIL

(The United States of Brazil—Estados Unidos do Brasil)

ADMINISTRATION

On January 20, 1941, by Decree No. 2,961, an Air Ministry was formed to control and co-ordinate all flying activities in Brazil. The Minister for Air is Major-General Armando Trompowski. The Department of Civil Aeronautics (Director : Dr. Cesar Grillo) is divided into four branches :—Administration, Traffic, Operations and Meteorology. The address of the Department is :—Departamento de Aeronautica Civil, Aeroporto Santos Dumont, Rio de Janeiro, Brazil.

ASSOCIATION

Aero Club do Brasil, 31 Rua Alvaro Alvin, Rio de Janeiro. Founded : 1911. President : Dr. Roberto Pimentel. Affiliated with the *Fédération Aéronautique Internationale* (F.A.I.). Controls the activities of all Flying Clubs in Brazil.

PUBLICATIONS

Azas (Wings). Founded in 1922. Published monthly. Official organ of the Aero Club do Brasil. Office : Rua Alvaro Alvin

BRAZIL—*continued.*

No. 31 and Rua 1° de Março 101, Rio de Janeiro. Director in charge: Cap. Salvador C. de Sá e Benevides. Chief Editor: José Garcia de Souza.

Aviação. Founded in 1937. Published monthly. Technical Director: L. Nobre de Almeida. Office: Rua Uruguayana No. 104 Rio de Janeiro.

Avião. Founded in 1942. Technical monthly. Director: Air Brigadier Lysias Augusto Rodrigues. Office: Rua 10 de Marco 7, Rio de Janeiro.

Esquadrilha. Founded in 1941. Periodical magazine published by the cadets of the Aeronautical School, Campo dos Affonsos, Rio de Janeiro.

Boletim do Ministerio da Aeronautica. Founded in 1941. Official monthly bulletin published by the Ministry of Aeronautics and containing all decrees, laws, dispatches, etc., concerning Brazilian air activities.

NATIONAL TRANSPORT COMPANIES

Aerovia S.A. de Minas Gerais.
Head Office: Rua Tamoios 36, Belo Horizonte, Minas Gerais.

Companhia Meridional de Transportes.
Head Office: Avenida Franklin Roosevelt 126, Sobre-loja, Rio de Janeiro.
This company operates unscheduled cargo services only. It owns three Avro Ansons.

Companhia Metropolitana de Transportes Aereos S.A.
Head Office: Avenida Rio Branco 181, 15 Andar, Sala 1504, Rio de Janeiro.
This company operates non-scheduled services only.

Empreza de Transportes Aerovias Brasil S.A.
Head Office: Avenida Presidente Wilson 198, Rio de Janeiro.
This company is a subsidiary of the T.A.C.A. organization. It owns six Douglas DC-3s and two Lockheed 12s.

Linha Aérea Transcontinental Brasileira.
Head Office: Avenida Erasmo Brago 20-A, Rio de Janeiro.
This company was formed in 1944 and plans to establish airlines through the interior of Brazil. It bought six Canadian-built Avro Ansons from the War Assets Corpn. in Canada.

Linhas Aéreas Brasileiras.
Head Office: Rua 28, de Setembro, 68, Belem do Para.
This company is authorised to operate from Rio de Janeiro to Bahia.

Navegacão Aérea Brasileira.
Head Office: Avenida Nilo Pecanha, 31, Rio de Janeiro.
Commonly called "N.A.B.", this company inaugurated its first service on September 9, 1941.

Panair do Brasil S.A.
Head Office: Aeroporto Santos-Dumont, Rio de Janiero.
This company was formed in 1930 as a subsidiary of Pan-American Airways. In 1944 control of the company was transferred to Brazilian interests and Pan American now has a 48% minority interest. The company claims to have the longest domestic network of air services (nearly 20,000 miles) of any airline in the Western Hemisphere. It has a staff of over 3,000.
Equipment includes aircraft of the following types:—Lockheed Constellation (3), Lockheed Lodestar, Sikorsky S-43 flying-boats and amphibians, Douglas DC-3 and Douglas DC-4.

S.A. Empresea de Viacão Aérea Rio Grandense. P.O. Box, 243, Porto Alegre.
This company, commonly known as "Varig," was started in conjunction with the now defunct Sindicato Condor in 1927 and took over services in the South of Brazil which for a short time previously had been flown by Condor itself. The company operates from headquarters at Porto Alegre entirely in the State of Rio Grande do Sul, from which it has received a subsidy since 1932.
Equipment includes aircraft of the following types:—Fiat G.2, D.H. 89, Lockheed Electra and Junkers F.13.

Serviços Aereos Cruzeiro do Sul, Ltda.
Head Office: Avenida Rio Branco, 128, P.O. Box 190, Rio de Janeiro.
This company, formerly known as Sindicato Condor Limitada, was taken over by the Brazilian Government in 1940 and renamed Serviços Aereos Condor Limitada. The re-organization was completed in November 1942, when the present name was adopted. The company has been selected as Brazil's "Chosen Instrument" and an agreement is proposed between Brazil, Argentina, and Chile for it to operate in conjunction with F.A.M.A. and L.A.N. on international services.
Equipment includes aircraft of the following types:—Douglas DC-4, Douglas DC-3, Focke-Wulf Fw 200, Junkers Ju 52, Lockheed Electra and ten Martin 202 (on order).

Viacão Aérea Santos Dumont S.A.
Head Office: Avenida President Wilson 327, Rio de Janeiro.
This company, formed in 1944, operates freight services from Rio de Janeiro to Salvador, Aracuju and Recife. Its fleet consists of three Consolidated Catalina flying-boats and one Budd twin-engined freight carrier.

Viacão Aérea São Paulo.
Head Office: Rua Libero Badaro 92, São Paulo.
This company, often known as "Vasp," operates internal air routes in Brazil based on São Paulo using Junkers Ju 52 and Douglas DC-3 aircraft.

INTERNATIONAL TRANSPORT COMPANIES

The following international air-carriers operate routes to and through Brazil:—

Air France (France).
British South American Airways (Great Britain).
Flota Aérea Mercante Argentina (Argentina).
Pan American World Airways (United States).
Pan American-Grace Airways (United States).

FLYING CLUBS

The Directorate of Civil Aviation, through a special Aero Club Department, gives help and encouragement to the Flying Clubs in many ways, one of the most important being the distribution of suitable instructional aircraft. Approximately 350 light aeroplanes of American and national manufacture are now owned by the approved clubs.

AERODROMES

For details of airports and aerodromes in Brazil reference should be made to the *Guia Aeronautica de Aeropistas*, abtainable through E. B. Covey, Avenida Roque Saenz Peña 615, Buenos Aires.

THE BRITISH COMMONWEALTH OF NATIONS

1—THE BRITISH EMPIRE

GREAT BRITAIN

ADMINISTRATION

The control of Civil Aviation in the United Kingdom is vested in the Minister of Civil Aviation, and orders are issued from time to time under his authority for the safety and benefit of all concerned with Civil flying in the British Isles.

The Ministry of Civil Aviation
Address: Ariel House, Strand, London, W.C.2.
Minister of Civil Aviation: The Rt. Hon. The Lord Nathan, P.C., T.D., M.P.
Parliamentary Secretary: G. S. Lindgren, M.P.
Permanent Secretary: Sir Henry Self, K.C.M.G., K.B.E., C.B., B.A., B.Sc., B.D.
Chief Aeronautical Adviser: Air Chief Marshal Sir Frederick Bowhill, G.B.E., K.C.B., C.M.G., D.S.O.
Permanent Under-Secretaries: H. G. Vincent, C.B., C.V.O., G. S. Dunnett, A. H. Wilson, C.B.E.
Deputy Secretary: W. C. G. Cribbett, C.M.G.
Director-General of Technical Services: Air Vice-Marshal A. C. Collier, C.B., C.B.E.

Air Registration Board
Address: Brettenham House, Lancaster Place, Strand, London, W.C.2.
Chairman: The Rt. Hon. Lord Brabazon of Tara, M.C., P.C.
Vice-Chairman: Sir Frederick Handley Page, C.B.E., F.R.Ae.S., A. B. Stewart, Guy F. Johnson, C.B.E. (Hon. Treasurer) and Sir Maurice Denny, Bt., K.B.E.
Other Members of the Board: Sir Roy Dobson, C.B.E., F.R.Ae.S., Capt. A. G. Lamplugh, C.B.E., F.R.Ae.S., M.I.Ae.S., F.R.G.S., C. C. Walker, A.M.I.C.E., F.R.Ae.S., J. D. North, F.R.Ae.S., M.I.A.E., Major R. H. Thornton, M.C., Wing Cdr. R. H. Stocken, F.R.Ae.S., L. Murray Stewart, J. J. Taylor, G. P. Olley, M.M., E. R. H. Hill, H. R. Perrin, C.B.E., F. C. R. Jaques.
Principal Surveyor: R. E. Hardingham, A.F.R.Ae.S.
Chief Surveyor (Design): Walter Tye, B.Sc., A.F.R.Ae.S.
Chief Surveyor (Engines): W. M. Evans, A.M.I.A.E.
Chief Surveyor (Airworthiness): J. Norman, A.F.R.Ae.S.

BRITISH COMMONWEALTH—GREAT BRITAIN—*continued.*

The Air Registration Board, set up in February, 1937, undertakes such functions in connection with design, construction and maintenance of civil aircraft as may be delegated to it by the Minister of Civil Aviation. It is responsible for the issue of Certificates of Airworthiness to all British civil aircraft.

ASSOCIATIONS

The Royal Aeronautical Society (with which is incorporated the Institution of Aeronautical Engineers). Founded: 1866. Offices: 4, Hamilton Place, W.1.

President: Sir Frederick Handley Page, C.B.E., F.R.Ae.S. Vice-Presidents: Dr. H. Roxbee Cox, Ph.D., D.I.C., B.Sc., F.R.Ae.S., Sir Oliver Simmonds, M.A., F.R.Ae.S. and N. E. Rowe. Librarian: Mr. J. E. Hodgson, Hon. F.R.Ae.S. Secretary: Captain J. Laurence Pretchard, Hon. F.R.Ae.S.

The Royal Aeronautical Society, founded in 1866, is the oldest institution in the World devoted to flying. It exists for the furtherance of the Science of Aeronautics.

Branches of the Royal Aeronautical Society exist in the following places:—Belfast, Birmingham, Bristol, Brough, Cambridge, Coventry, Derby, Glasgow, Gloucester and Cheltenham, Hatfield, Isle of Wight, Leicester, Luton, Manchester, Portsmouth, Reading, Rochester, Southampton, Weybridge, Yeovil, and overseas at Sydney, Australia; Montreal and Ottawa, Canada; Capetown, S. Africa; Wellington, New Zealand.

The Royal Aero Club of the United Kingdom. Founded: 1909. Offices: 119, Piccadilly, London, W.1. Affiliated to the *Fédération Aéronautique Internationale.* President: Lord Brabazon of Tara, M.C., P.C. Vice-Presidents: The Duke of Sutherland, K.T., The Marquess of Londonderry, K.G., P.C., M.V.O., Lord Gorell, C.B.E., M.C., Captain Sir Geoffrey de Havilland, O.B.E., Lt-Col. Sir Francis K. McClean, A.F.C., Sir W. Lindsey Everard, D.L., J.P., and Sir Frederick Handley Page, C.B.E. Chairman: Air Cdre. Whitney Straight, C.B.E., M.C., D.F.C. Secretary-General: Colonel Rupert Preston, C.B.E.

The Royal Air Force Club. Founded: 1918. Offices: 128, Piccadilly, London, W.1. Secretary: Air Cdre. W. H. Dunn, C.B.E., D.S.C., R.A.F. (retired).

This Club exists for the association of officers of the R.A.F., the Fleet Air Arm and the Air Forces of the Dominions and Colonies, and its ordinary membership is confined exclusively to such officers. It was formed originally as the Royal Flying Corps Club.

The Society of British Aircraft Constructors, Ltd. Incorp.: 1916. Offices: 32, Savile Row, London, W.1. President: W. R. Verdon Smith (Bristol Aeroplane Co., Ltd.). Deputy President: Arthur Gouge, B.Sc., M.I.Mech.E., F.R.Ae.S., F.I.Ae.S. (U.S.A.) (Saunders-Roe, Ltd). Vice-President: Robert Blackburn, O.B.E., A.M.I.C.E., F.R.Ae.S., M.I.M.E. (Blackburn Aircraft, Ltd.). Management Committee: H. Burroughes (Gloster Aircraft Co., Ltd.), Sir Roy Dobson, C.B.E. (A. V. Roe & Co., Ltd.), H. P. Folland (Folland Aircraft, Ltd.), E. W. Hives, C.H., M.B.E. (Rolls-Royce, Ltd.), Major H. R. Kilner, M.C. (Vickers-Armstrongs, Ltd.), F. G. Miles (Miles Aircraft, Ltd.), Sir Frederick Handley Page (Handley Page, Ltd.), F. E. N. St. Barbe (de Havilland Aircraft Co., Ltd.), Sir Frank Spriggs (Hawker Aircraft, Ltd.), Major C. J. B. Ball, D.S.O., M.C. (Magnesium Elektron, Ltd.) and J. E. Chorlton (Smith's Aircraft Instruments, Ltd.). Director: E. C. Bowyer.

The Society is officially recognized as the representative body of the British Aircraft Industry. It acts by agreement in co-operation with the Royal Aeronautical Society and the Royal Aero Club in all matters of common interest.

The Guild of Air Pilots and Air Navigators of the British Empire. Offices: Londonderry House, Park Lane, London, W.1.

The Guild was founded on October 1, 1929, to further the efficiency of commercial aviation and to uphold the dignity and prestige of air pilots and navigators. Permanent Grand Master: H.R.H. Princess Elizabeth. Master: The Marquess of Londonderry, K.G., P.C., M.V.O. Deputy Master: Wing Cdre. N. A. Woodhead, D.S.C., A.F.C. Secretary-General: I. L. S. McNicol. Clerk: Lawrence A. Wingfield, M.C., D.F.C. Treasurer: Wing Cdr. C. A. Pike, A.F.C., A.F.R.Ae.S. Assistant Treasurer: Francis Chichester.

The Air League of the British Empire. Date of Incorp.: 1909. Offices: Kinnaird House, 1a, Pall Mall East, London, S.W.1. President: The Rt. Hon. The Earl of Harewood, K.G., G.C.V.O., D.S.O., T.D. Chairman of the Executive Committee: Major R. H. Mayo, O.B.E., A.M.Inst.C.E., F.R.Ae.S. Secretary-General: E. Colston Shepard. Hon. Treasurer: J. Arthur Rank, D.L., J.P.

The British Air Line Pilots Association. Founded 1937. Offices: 9-10, Marble Arch, London, W.1. President: His Grace the Duke of Hamilton and Brandon, A.F.C. Chairman: Capt. J. W. G. James, O.B.E. Secretary: Denis Follows.

The principal objects of the Association are to protect, improve and advance the interests of its members and of the profession generally.

Society of Licensed Aircraft Engineers. Address: Finsbury Circus House, Blomfield Street, London, E.C.2. Secretary: E. C. Rogers, B.Sc. The object of the Society is to advance the interests of Licensed Aircraft Engineers.

The British Gliding Association. Founded 1929. Offices: Londonderry House, 17, Park Lane, London, W.1. Chairman: Dudley Hiscox. Secretary: E. H. D. Spence.

Controls the sport of gliding in the United Kingdom under powers delegated by the Royal Aero Club.

The Aerodrome Owners Association. Founded 1934. Offices: Londonderry House, 17, Park Lane, London, W.1. Secretary: H. R. Gillman, A.F.R.Ae.S.

Founded to protect the interests of aerodrome owners generally.

The British Air Charter Association. Founded 1946. Offices: Londonderry House, 17, Park Lane, London, W.1. Secretary: H. R. Gillman, A.F.R.Ae.S.

Represents the interests of all British companies operating charter or other non-scheduled air services.

The Association of British Aero Clubs. Founded 1946. Offices: Londonderry House, 17, Park Lane, London, W.1. Chairman: Air Cdr. Whitney Straight, C.B.E., M.C., D.F.C. Secretary: Colonel R. L. Preston, C.B.E. Assistant Secretary: E. H. D. Spence.

Founded to take over the work of the Associated Clubs Council of the Royal Aero Club. Its objects are the promotion and encouragement of flying through the medium of clubs for the benefit and in the interests of the British public.

The Aeronautical Research Council. Founded on May 5, 1909, as the Advisory Committee for Aeronautics. The Council disseminates the results of official research and advises on theoretical problems of aeronautics. Chairman: Professor Sydney Goldstein, F.R.S.

The Society of Model Aeronautical Engineers. Founded in 1920. Address: Londonderry House, 17, Park Lane, London, W.1. Chairman: A. F. Houlberg. Hon. Secretary: L. M. Walker.

The Circle of Aviation Writers. Founded 1940. Address: 40, Fleet Street, London, E.C.4. President: G. Geoffrey Smith, M.B.E. Hon. Secretary: Alan Tomkins.

The Helicopter Association of Great Britain. Founded 1945. Address: 115, Leadenhall Street, London, E.C.3. Chairman: Sqd. Ldr. H. A. Marsh, A.F.C. Hon. Secretary: Basil Arkell.

The Helicopter Society of Great Britain. Founded 1945. Address: 25, Taptonville Road, Sheffield, 10. President: Group Capt. The Hon. Max Aitken, D.S.O., D.F.C., M.P. Vice-President: Dr. A. P. Thurston, M.B.E., F.R.Ae.S. Hon. General Secretary: R. W. Allott, A.R.Ae.S.

The Aeronautical Engineers' Association. Founded 1943. Head Office: 108, Church Street, Croydon, Surrey. President: H. Tremain. General Secretary: J. H. Stevenson. Branch offices in Swindon, Wolverhampton, Carlisle, Dumfries and Belfast.

PUBLICATIONS

A.B.C. Air Guide. Published monthly, price 2/6, by Thomas Skinner & Co. (Publications), Ltd., 141, Fetter Lane, London, E.C.4.

The Aero Modeller. Incorporating the Model Aeroplane Constructor. Published monthly, price 1/3, by The Model Aeronautical Press, Ltd., Allen House, Newarke Street, Leicester. Editor: C. S. Rushbrooke.

Aeronautics. Published monthly, price 2/-, by C. Arthur Pearson, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Editor: Oliver Stewart, M.C., A.F.C.

The Aeroplane. Founded in 1911 by C. G. Grey. Published weekly, price 1/-, by Temple Press, Ltd., Bowling Green Lane, London, E.C.1. Editor: Thurstan James.

The Aeroplane Spotter. Incorporating the Bulletin of The National Association of Spotters' Clubs. Published fortnightly, price 3d., by Temple Press, Ltd., Bowling Green Lane, London, E.C.1. Editor: Charles W. Cain.

Air Mail. The Official Organ of the R.A.F. Association. Published monthly, price 6d., by R.A.F. Association Publishing Co., Osnaburgh House, Osnaburgh Street, London, N.W.1.

The Air Reserve Gazette. Incorporating the Air Training Corps Gazette. Published monthly, price 6d., for the Air League of the British Empire, 1a, Pall Mall East, London, S.W.1., by the Rolls House Publishing Co., Ltd. Editor: Leonard Taylor.

Air Review. Published monthly, price 2/-, by Air Review, Ltd., The Aerodrome, Billington Road, Stanbridge, Bedfordshire. Editors: E. J. Riding and O. G. Thetford.

Air Transport. Published monthly, price 1/-, by "Air Transport" Publishing Co., Ltd., Associate of Staples Press, Ltd., Cavendish Place, London, W.1. Editor: A. James Payne.

Air Transport and Airport Engineering. Published monthly, price 1/-, by Temple Press, Ltd., Bowling Green Lane, London, E.C.1. Editor: John Longhurst.

Aircraft Engineering. Published monthly, price 2/-, by Bunhill Publications, Ltd., 12, Bloomsbury Square, London, W.C.1 Editor: Lt.-Col. W. Lockwood Marsh, O.B.E., F.R.Ae.S., M.S.A.E., F.I.Ae.S.

BRITISH COMMONWEALTH—GREAT BRITAIN—*continued.*

Aircraft Production. Published monthly, price 2/-, by Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Editor: W. E. Goff.

Bradshaw's British and International Air Guide. Published monthly, price 3/-, by Bradshaw's Air Guide, Bradshaw House, Surrey Street, London, W.C.2.

Airports and Air Transportation. Published monthly, price 1/-, by Clarke & Hunter (London) Ltd., 92, Victoria Street, London, S.W.1. Editor: W. E. Percival.

All the World's Aircraft. Founded in 1909 by the late Fred T. Jane. Published annually, price £3 3s. 0d., by Sampson Low, Marston & Co., Ltd., 43, Ludgate Hill, London, E.C.4. Edited and compiled by Leonard Bridgman.

Flight. The Official Journal of the Royal Aero Club. Founded 1909. Published weekly, price 1/-, by Flight Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1. Editor: C. M. Poulsen.

The Light Plane and Private Owner. Published monthly, price 1/6, by Light Plane Publications, Ltd., 4, Sutherland Avenue, Maida Vale, London, W.9. Editor: H. M. Berney.

Model Aircraft. The Journal of the Society of Model Aeronautical Engineers. Published monthly, price 1/-, by Percival Marshall & Co., Ltd., 23, Great Queen Street, London, W.C.2. Editor: A. F. Houlberg, A.F.R.Ae.S.

The Journal of the Royal Aeronautical Society. The Official Organ of the Royal Aeronautical Society. Founded 1897 as the Aeronautics Journal. Published monthly, price 7/6, by The Royal Aeronautical Society, 4, Hamilton Place, London, W.1. Editor: Joan Bradbrooke.

The Royal Aero Club Gazette. Published monthly by the Royal Aero Club, 119, Piccadilly, London, W.1., for distribution to all members and associate members.

The Royal Air Force Quarterly. Published quarterly, price 5/-, by Gale & Polden, Ltd., Ideal House, Argyll Street, London, W.1. Editor: Wing-Cdre. C. G. Burge, O.B.E.

The Sailplane and Glider. Published monthly, price 1/-, for the Glider Press, Ltd., 139, Strand, London, W.C.2., by The Rolls House Publishing Co., Ltd Editor: Flt. Lt. Vernon Blunt.

Weather. Published monthly, price 1/6, by the authority of the Royal Meteorological Society. Editorial Offices: 49, Cromwell Road, London, S.W.7. Joint Editors: A. J. Drummond, F.R.Met.S.; J. S. Forrest, M.A., B.Sc., F.Inst.P.; A. R. Meetham, M.A., D.Phil., and Wing-Cdr. R. M. Poulter, O.B.E.

Who's Who in British Aviation. Published annually, price 10/6, by Temple Press, Ltd., Bowling Green Lane, London, E.C.1.

FLYING CLUBS

On January 1, 1946, the ban on civil flying was lifted and a system of fuel rationing was introduced to permit the revival of club and school flying.

The Socialist Government has declared its policy not to give any financial assistance or subsidy for pilots trained to flying clubs, but 100 light training aircraft surplus to service requirements were made available at a nominal price for distribution among the clubs, on whom rested the responsibility of putting the aircraft into a state of airworthiness.

At the time of writing 57 Flying Clubs were listed as being in operation, or preparing to operate as soon as aircraft and/or airfield became available.

TRANSPORT COMPANIES

The policy of the British Government is that the air transport services of the United Kingdom shall be under national ownership and control. Under this policy the Government has established three separate statutory corporations with the following spheres of responsibility: (*a*) routes between the United Kingdom and other Commonwealth countries the United States and the Far East (to be operated by British Overseas Airways); (*b*) internal routes in the United Kingdom and routes to the continent of Europe (British European Airways); and (*c*) routes between the United Kingdom and South America (British South American Airways).

British Overseas Airways Corporation.
Head Office: Airways House, 20, Berkeley Square, London, W.1.

Board of Directors: Sir Harold Hartley, K.C.V.O., C.B.E., M.C. (Chairman), Sir Harold G. Howitt, G.B.E., D.S.O., M.C. (Deputy Chairman), W. Whitney Straight, C.B.E., M.C., D.F.C. (Managing Director-Chief Executive), Major J. R. McCrindle (Managing Director, External Affairs). Other members: Lord Burghley, K.C.M.G., Mr. G. M. Garro-Jones, Major R. H. Thornton, M.C., Sir Clement Jones, K.B.E., C.B., Lord Rothschild, G.M., and Mr. H. L. Newlands, M.B.E. Secretary: Mr. D. S. S. Macdowall. The members of the Board of the British Overseas Airways Corporation are appointed by the Minister of Civil Aviation.

British Overseas Airways Corporation was established in 1939 under the British Overseas Airways Act of that year, and acquired on April 1, 1940, the air transport undertakings of Imperial Airways, Ltd. and British Airways, Ltd., which had been at the disposal of the Secretary of State for Air since the outbreak of war. It is the largest of the three Corporations set up by the Government to develop British air transport under the provisions of the Civil Aviation Act of August, 1946. Its functions are to operate the Commonwealth and Empire, North Atlantic and Far Eastern routes from the United Kingdom, and any ronte not within the sphere of the British European Airways or British South American Airways.

Operating Divisions.

African and Middle East. Headquarters: 4, Sharia Baehlar, Kasr el Nil, Cairo.

Eastern. Headquarters: Finlay House, McLeod Road, Karachi, Sind.

Atlantic. Headquarters: Room 3518, 630, Fifth Avenue, New York, 20.

Home Stations. Headquarters: Airways Terminal, Buckingham Palace Road, London, S.W.1.

The Corporation's main landplane base in the United Kingdom is at Heathrow (London Airport). Maintenance bases are at Hurn (Hants.), Bovingdon (Hertfordshire), and Whitchurch (Bristol). The flying boat base is at Poole (Dorset), with the maintenance base at Hythe (Hants).

The base for repairs, modifications and annual overhaul is at Croydon. There is an experimental factory for research at Brislington (Bristol).

There are bases overseas at Cairo and Montreal for major maintenance.

Fleet (as at October 1, 1946):—Landplanes: 164, Flying-boats: 42, Total: 206. Out of this total 40 are used for training and development. The following types are included:—**Landplanes:** Avro York (30), Avro Lancastrian (15), Handley Page Halton (6), Handley Page Halifax (9), Douglas Dakota (45), Lockheed Constellation (5), Airspeed Oxford (10), Vickers Viking (8), Consolidated Linerator (10), Lockheed Lodestar (19), Avro Tudor I (1), Percival Proctor (1), D.H. Dove (1), Avro Anson (2), Avro Lancaster (2). **Flying-boats:** Short "C" Class (13), Short "G" Class (1), Short "Hythe" Class (19), Boeing 314a (3), Short Sunderland III and IV (5), Short Seaford (1).

British European Airways Corporation. Head Office: 16, Upper Grosvenor Street, London, W.1. Chief Operations Base: Bourne School, Northolt, Middlesex.

Board of Directors: Gerard d'Erlanger (Chairman), J. V. Wood (Managing Director), I. J. Hayward, Wing Cdre. A. H. Measures, C.B.E. and J. W. S. Braneker (Dupnty Director and Traffic Manager). Manager, Scottish Division: Geo. Nicholson.

On August 1, 1946, British European Airways Corporation assumed the responsibility of operating all air routes between the United Kingdom and the Continent, together with all internal air routes within Great Britain. Prior to that date all European services had been operated by a European Division of British Overseas Airways, which took over the post-war continental air services initiated by the Royal Air Force.

Pending the formation of the English and Scottish Divisions of the Corporation, the U.K. internal services were operated on a three-monthly agreement by their former privately-owned operators. On February 1, 1947, the operation of all British internal air lines was formally taken over by British European Airways and the private companies ceased to exist.

British South American Airways Corporation. Head Office: 19, Grafton Street, London, W.1.

Board of Directors: J. W. Booth (Chairman), J. W. Stephenson (Deputy Chairman), Air Vice-Marshal D. C. T. Bennett, C.B., C.B.E., D.S.O. (General Manager), Sir Edwin N. Plowden, G. McT. Sheppard. Secretary to the Board: B. G. Porter, D.F.C.

This corporation was originally formed by the following shipping companies engaged in the South American traffic:—Royal Mail Line, Booth Steamship Co., Ltd., Blue Star Line, Pacific Steam Navigation Co., Ltd. and Lamport & Holt, Ltd. It is now one of the three nationalised corporations which have been set up under the British Civil Aviation Bill.

Equipment: Avro Lancastrian, Avro York.

CHARTER COMPANIES

Air Charter, Ltd. Address: 20, Dover Street, London, W.1.

Air Commerce, Ltd. Address: Croydon Airport, Surrey.

Air Kruse (Kent), Ltd. Address: Lympne Airport, Kent.

Air Taxis, Ltd. Address: Croydon Airport, Surrey.

Airwork, Ltd. Address: 134, Bath Road, Hounslow, Middlesex.

Amalgamated Air Services, Ltd. Address: White Waltham Aerodrome, near Maidenhead, Berks.

British Air Transport, Ltd. Address: Kenley Aerodrome, Surrey.

British American Air Services, Ltd. Address: 2, Jones Street, Berkeley Square, London, W.1.

Cambrian Air Services, Ltd. Address: Cardiff Airport.

BRITISH COMMONWEALTH—GREAT BRITAIN—*continued.*

Herts and Essex Aviation, Ltd. Address: Broxbourne Aerodrome, Nazeing, Essex.
Hunting Air Travel, Ltd. Address: 29, Clarges Street, London, W.1.
Island Air Charters, Ltd. Address: Jersey Airport, C.I.
Kennings, Ltd. Address: Derby Airport, Derby.
Lancashire Aircraft Corporation, Ltd. Address: Stanley Park Aerodrome, Blackpool, Lancs.
London Aero & Motor Services. Address: Stanstead Aerodrome, near Bishop's Stortford.
McDonald Aircraft, Ltd. Address: Balado Airport, Kinross, Scotland.
Modern Air Services, Ltd. Address: White Waltham Aerodrome, near Maidenhead, Berks.
Morton Air Services, Ltd. Address: Croydon Airport, Surrey.
North Sea Air Transport, Ltd. Address: Hanworth Air Park, Feltham, Middlesex. Subsidiary of Blackburn Aircraft, Ltd.
Olley Air Service, Ltd. Address: Croydon Airport, Surrey.
Portsmouth Aviation, Ltd. Address: The Airport, Portsmouth, Hants.
Rex Hire Service. Address: 11, Rex place, Park Lane, London, W.1.
Scottish Aviation, Ltd. Address: Prestwick Airport, Ayrshire, Scotland.
Skytravel, Ltd. Address: 20, Edwards Lane, Speke, Liverpool.
Skyways, Ltd. Address: 175, Piccadilly, London, W.1.
Southampton Air Services, Ltd. Address: Southampton Airport, Eastleigh, Hants.
Universal Flying Services, Ltd. Address: Fair Oaks Aerodrome, Chobham, Surrey.
Westminister Airways, Ltd. Address: 78, Buckingham Gate, London, S.W.1.

CUSTOMS AIRPORTS

Customs clearance facilities for civil aircraft are at present provided at the following State-controlled aerodromes in Great Britain and Northern Ireland (excluding the Channel Islands).
BELFAST (Sydenham). Lat. 54°37′N., Long. 05°52′W. East side of Belfast Docks, N. Ireland. Runways 046°-226° 1,120 yds., 014°-323° 1,090 yds. Height above sea level 19 ft.
BRISTOL (Whitchurch). Lat. 51°25′N., Long. 02°35′W. 3 miles S. of Bristol city. One runway 102°-282° 1,020 yds. Grass area N.-S. 900 yds., N.E.-S.W. 800 yds., S.E.-N.W. 960 yds. Height above sea level 200 ft.
CROYDON. Lat. 51°21′N., Long. 00°07′W. 2 miles S.W. of Croydon, Surrey. Grass field N.-S. 1,200 yds., N.E.-S.W. 1,280 yds., E.-W. 1,150 yds., S.E.-N.W. 990 yds. Height above sea level 230 ft.
GATWICK. Lat. 51°09′N., Long. 00°10′W. 6 miles S. of Redhill, Surrey. Runways 058°-238° 1,400 yds., 097°-277° 1,200 yds. (wire mesh). Height above sea level 200 ft.
HURN. Lat. 50°47′N., Long. 01°51′W. 4 miles N.N.E. of Bournemouth, Hants. Runways 085°-265° 2,000 yds., 130°-310° 1,200 yds., 175°-355° 1,620 yds. (tarmac). Height above sea level 35 ft. At present normally limited to aircraft operating on scheduled services.
LIVERPOOL (Speke). Lat. 53°21′N., Long. 02°53′W. 6 miles S.E. of Liverpool. Runways 040°-220° 1,430 yds., 080°-260° 1,670 yds., 169°-349° 1,000 yds. (concrete). Landing and taxying on grass not allowed. Height above sea level 65 ft.
LONDON (Heathrow). Lat. 51°28′N., Long. 00°27′W. 14 miles W. of Westminister Bridge. Two runways available at present 100°-280° 3,000 yds., 050°-230° 2,000 yds. Height above sea level 80 ft. Normally limited to aircraft operating on scheduled services.
LYMPNE. Lat. 51°05′N., Long. 01°01′W. 2½ miles W. of Hythe, Kent. Grass field N.-S. 1,140 yds., N.E.-S.W. 1,130 yds., E.-W. 1,220 yds., S.E.-N.W. 1,160 yds. Height above sea level 340 ft.
MANCHESTER (Ringway). Lat. 51°21′N., Long. 02°16′W. 4 miles S.W. of Altrincham, Lancs. Runways 020°-200° 2,000 yds., 060°-240° 1,400 yds., 100°-280° 1,100 yds. (tarmac). Height above sea level 235 ft.
NORTHHOLT. Lat. 51°33′N., Long. 00°25′W. 2½ miles E. by N. of Uxbridge, Middlesex. Runways 080°-260° 1,840 yds., 128°-308° 1,600 yds. Height above sea level 120 ft. Normally limited to aircraft operating on scheduled services.
PRESTWICK. Lat. 55°30′N., Long. 04°26′W. 3 miles N.N.E. of Ayr, Scotland. Runways 076°-256° 1,500 yds., 135°-315° 2,200 yds. (concrete). Height above sea level 35 ft.
SOUTHAMPTON (Eastleigh). Lat. 50°57′N., Long. 01°22′W. 4 miles N.N.E. of Southampton, Hants. Grass field N.-S. 1,450 yds., N.E.-S.W. 1,170 yds., E.-W. 800 yds., S.E.-N.W. 850 yds. Height above sea level 37 ft.
In addition to the above, customs clearance facilities are also provided at Jersey (St. Peter) and Guernsey aerodromes in the Channel Islands. These airports are controlled by the States of Jersey and Guernsey respectively.

CUSTOMS FLYING-BOAT BASE

POOLE. Lat. 50°42′N., Long. 01°59′W. In Poole Harbour. Alighting lanes 012°-192° 1,500 yds., 090°-270° 1,800 yds., 110°-290° 1,800 yds., 120°-300° 2,640 yds.

ANGLO-EGYPTIAN SUDAN

TRANSPORT COMPANY

Sudan Airways.

Head Office: Khartoum.
This company was formed in 1946 with capital provided by the Sudan Government. Airwork, Ltd. are to handle the flying and technical services while the commercial side will be a responsibility of the Sudan Railways. Four D.H. Dove aircraft are on order.

OTHER TRANSPORT COMPANIES

(Operating routes to and through the Sudan)
Air France (France).
British Overseas Airways Corpn. (Great Britain).
S.I.L.A. (Sweden).

AIRPORTS

WADI HALFA. Lat. 21°50′N., Long. 31°18′E. Altitude 502 ft. Runways N.-S. 1,500 yds. × 50 yds. (night only), N.-S. 1,500 yds. × 50 yds., E.-W. 1,600 yds. × 100 yds. (daytime strips).
PORT SUDAN. Lat. 19°35′N., Long. 37°12′E. Altitude 10 ft. Sand runways N.-S. 1,950 yds. × 100 yds., N.E.-S.W. 1,300 yds. × 100 yds.
KASSALA. Lat. 15°28′N., Long. 36°25′E. Altitude 1,600 ft.
JUBA. Lat. 04°52′N., Long. 31°37′E. Altitude 1,485 ft. Runways N.E.-S.W. 1,100 yds. × 55 yds., N.W.-S.E. 1,900 yds. × 50 yds.
EL GENEINA. Lat. 13°29′N., Long. 22°27′E. Altitude 2,641 ft. Runways N.E.-S.W. 1,700 yds. × 50 yds.
EL FASHER. Lat. 13°37′N., Long. 25°20′E. Altitude 2,395 ft. Runways N.-S. 1,778 yds. × 50 yds., N.E.-S.W. 2,000 yds. × 50 yds., E.-W. 1,240 yds. × 50 yds.

ANTIGUA

Civil Aviation in Antigua comes under the jurisdiction of the Colonial Secretariat.

INTERNATIONAL TRANSPORT COMPANIES

(Operating to and through Antigua)
Pan American World Airways.
British West Indian Airways.

AIRPORT

Both the above companies, by permission of the United States Government, use Coolidge Field, the U.S. Army air base situated about 5 miles from St. John's city. The field has all facilities for day and night flying, etc.

THE BAHAMA ISLANDS

ADMINISTRATION

The administration of civil aviation in the Bahamas is under the control of the Director of Civil Aviation, who is responsible to H.E. the Governor. In addition, there is an Air Board, of which the Director of Civil Aviation is a member, to advise the Governor. This Board was set up on November 28, 1933, under Article 30 of the Air Navigation (Colonies, Protectorates and Mandated Territories) Order, 1927. The Director of Civil Aviation is Wing Cdr. E. H. Coleman, A.F.C.

During the war a large amount of flying was conducted in the Bahamas by the R.A.F. when an Operational Training Unit and a Wing of R.A.F. Transport Command was operating at Nassau. Military flying was carried out at two airfields on the island of New Providence namely, Oakes and Windsor Fields.

On June 1, 1946, the R.A.F. formally transferred the operation of Oakes Field to the Bahamas Government and this airport is now the official Port of Entry for landplanes, service and civil. For seaplanes there is an established base one mile East of Nassau, which is also registered as a Port of Entry.

TRANSPORT COMPANY

Bahamas Airways, Ltd.
Head Office: Bay Street, Nassau.
Formed in 1936 by the late Sir Harry Oakes and began operations in November of that year. In 1944 Pan American Airways acquired a minority interest in Bahamas Airways.
Aircraft:—Consolidated Commodore, Grumman G-21A.

INTERNATIONAL TRANSPORT COMPANY

The following company operates regularly to and from the Bahamas:—
Pan American World Airways.

BRITISH COMMONWEALTH—THE BAHAMA ISLANDS—*continued.*

FLYING CLUB

The Bahamas Flying Club, which was formed in 1940, has not yet been revived since the end of the war.

AIRPORT

OAKES FIELD. The only landplane Customs and Immigration Airport of Entry. 2½ miles S. of Nassau. Altitude above mean sea level 10 ft. Three runways 030°-210° 5,000 ft. × 150 ft., 120°-310° 5,000 ft. × 150 ft., 090°-270° 6,000 ft. × 150 ft. Level surface of crushed coral 75 ft. wide on either side of all runways. Full night-flying facilities. Complete control tower and meteorological services. Main airport building used at present by Pan American Airways.

SEAPLANE STATION

NASSAU SEAPLANE BASE. Customs and Immigration Port of Entry one mile E. of the centre of Nassau. Owned and operated by Pan American Airways. Alighting area in Nassau Harbour. Ramp available for beaching seaplanes. Passenger station. No night landing facilities.

Seaplane landings may be made at WEST END, GRAND BAHAMA, BIMINI and CAT BAY subject to weather and conditions of sea. All are approved as Customs seaplane landing areas but aircraft services and refuelling facilities are not available.

BARBADOS

ADMINISTRATION

Civil Aviation in Barbados is subject to Air Navigation Directions issued by the Governor under Article 30 of the Air Navigation (Colonies, Protectorates, and Mandated Territories) Order, 1927. The Managing Authority is the Colonial Secretary, Barbados.

INTERNATIONAL TRANSPORT COMPANY

The following air-carrier operates services to and from Barbados :—

British West Indian Airways, Ltd.

FLYING CLUB

None at present, but it is expected that the Barbados Aero Club will be revived as soon as it is possible to buy suitable light aircraft.

AIRPORT

SEAWELL. Lat. 13°04½'N., Long. 59°29¼' W. 7½ miles from Bridgetown, 11 miles by road. Altitude above mean sea level 167 ft. One hard-surfaced runway E.-W. 5,200 ft. × 160 ft. Parking apron 220 ft. × 100 ft. on northern side of runway about 100 yds. eastward of terminal building. Normally open to civil aircraft during daylight hours. The managing authority is the Harbour and Shipping Master, Barbados. Control of landings is, as a temporary measure, exercised by British West Indian Airways.

BERMUDA

ADMINISTRATION

Civil Aviation is administered on behalf of the Colonial Secretariat by the Bermuda Airport Board, Hamilton, Burmuda. Chairman: Capt. the Hon. N. B. Dill, M.C.P. Air Adviser to the Airport Board and Registrar of Aircraft: Wing Cdr. E. M. Ware, D.F.C.

AIR TRANSPORT COMPANIES

British Overseas Airways Corporation.

Address: The Manager, B.O.A.C., Front Street, Hamilton, Bermuda.

The Corporation is maintaining a Bermuda—Baltimore service with flying-boats, which are based at Baltimore, with Darrell's Island as the Bermuda terminal.

Pan American World Airways.

Address: The Manager, P.A.A., Front Street, Hamilton, Bermuda.

Under a temporary agreement, Pan American World Airways is operating a landplane shuttle service from New York. Kindley Field is the Bermuda terminal.

FLYING CLUB

Bermuda Flying Club.

Secretary: John Watlington, Bermuda Flying Club, Hamilton, Bermuda.

This club was recently formed and has taken over the Bermuda Flying School equipment, consisting of two Luscombe Silvaire seaplanes.

AIRPORT

KINDLEY FIELD. Under a temporary agreement the U.S. Army Air Forces air base has been opened for commercial use by properly certificated aircraft of the United Kingdom and the United States. Lat. 32°22'N., Long. 64°42'W., around Long Bird Island, in Castle Harbour. Altitude above mean sea level 11 ft. Three runways 010-190° 5,300 ft. × 150 ft., 120°-300° 8,000 ft. × 150 ft., 080°-260° 5,800 ft. × 150 ft. Tower control by U.S.A.A.F. Full night-flying facilities. Customs, temporary passenger terminal and trans-Atlantic weather forecasting service.

SEAPLANE BASE

DARRELL'S ISLAND. Bermuda Government Marine Airport managed by British Overseas Airways Corpn. Lat. 32°16'N., Long. 64°49'W., in Great Sound, West of Hamilton. Stretches of unobstructed water in all directions at least 10,500 ft. × 1,200 ft. Tower control and Control launch manned by B.O.A.C. Full night-flying facilities.

BRITISH GUIANA

ADMINISTRATION

Civil Aviation is under the control of the Air Board, the principal officials of which are the Commissioner of Police, the Comptroller of Customs and the Harbour Master.

TRANSPORT COMPANY

British Guiana Airways, Ltd.

Head Office: 32, Main and Hope Street, Georgetown.
Directors: Major A. J. Williams and John H. Hunter.
Aircraft :—Three Grumman G-21A twin-engined and two Ireland single-engined boat emphibians.

INTERNATIONAL TRANSPORT COMPANIES

The following companies operate air services to and through British Guiana :—

British West Indian Airways, Ltd.

This company operates a weekly service between Trinidad and Barbados, via Mackenzie.

Pan American World Airways

AIRPORT

ATKINSON FIELD, which was completed in 1942, is a U.S. Army Air-Base which is used mainly for Caribbean defence and military transport purposes. Pan American Airways are permitted to use this base.

SEAPLANE STATION

Pan American Airways maintains a seaplane station near GEORGETOWN. Lat. 60°48'N., Long. 58°10'W.

British Guiana Airways, Inc., owns and maintains a hangar and repair shop on the left bank of the Demarara River.

BRITISH HONDURAS

ADMINISTRATION

The Government of British Honduras governs Civil Aviation in the Colony subject to Air Navigation Directions issued by the Governor under Article 30 of the Air Navigation (Colonies, Protectorates and Mandate Territories) order, 1927. Mr. R. K. Masson, the Harbour Master, Custom House, Belize, is the authority for registration of aircraft.

INTERNATIONAL TRANSPORT COMPANIES

The following companies operate services to and through British Honduras :—

Transportes Aereos Centro Americanos (T.A.C.A.).
Transportes Aereos Mexicanos, S.A. (T.A.M.S.A.).
British West Indian Airways (B.W.I.A.).

AIRPORTS

STANLEY FIELD (Belize). Lat. 17°32'10"N., Long. 88°18'20"W. About 10 miles N.W. of the city. Runway 16 ft. above mean sea level, bearing N. 77°02'14"E. Consists of an asphalt surface strip 150 ft. × 5,000 ft. with an additional 500 ft. at each end and shoulders of 75 ft. along the entire strip. Radio, weather forecasting (obtained from Jamaica, B.W.I. subject to prior warning of four hours) re-fuelling facilities (during daylight hours only).

EL CAYO. Lat 17°09'17"N., Long. 89°04'05"W. Grass strip 150 × 2,000 ft. Height above mean sea level 150 ft. Bearing N.19°28'31"E., adjacent to N.E. side of town on W. side of the Belize River. Wind cone. No facilities.

COROZAL. Lat. 18°22'40"N., Long. 88°25'39"W. Grass strip 150 × 2,000 ft. Height above mean sea level 40 ft. Bearing N.17°E. 3 miles S.W. of the town. Wind Cone. No facilities.

CEYLON

ADMINISTRATION

The Directorate of Civil Aviation in Ceylon is under the Minister of Communications and Works. Mr. L. S. B. Perara formerly Secretary to the Minister of Communications and Works, was appointed early in 1946 to be Director of Civil Aviation. The Department is being re-organized for the increasing services demanded of it in connection with the regulation and development of air transport. The following executive staff will be appointed in due course:—Technical Assistant, Communications Officer, Inspector of Aircraft, Aerodromos Officer, and Assistant Aerodrome Officers (Flying Control).

FLYING CLUBS

The Aero Club of Ceylon, Ltd., Colombo Airport, Ratmalana, Mt. Lavinia, Ceylon.

President: Mr. Bernard Jayasuriya. Vice-Presidents: A. A. Rajasingham, Justin Kotalawela, J. H. P. de Soysa and K. Candavanam. Secretary: V. P. Senanayake.

The Aero Club of Ceylon which was inaugurated in 1938 has arranged to resuscitate flying after a period of enforced inactivity owing to war conditions. The Club has acquired a Stinson Sentinel, and is negotiating the purchase of more training aircraft.

Colombo Flying Club, Colombo Airport, Ratmalana, Mt. Lavinia, Ceylon.

President: Mr. M. G. Dover. Vice-President: Mr. A. W. Harrison. Hon. Secretary: Mr. R. A. Tomlinson. Hon. Treasurer: Mr. H. L. Knudson.

The Colombo Flying Club was inaugurated in 1943. No active flying was possible during war years. It has acquired 3 Stinson Sentinel L-5E and 2 Stinson Reliant aircraft and has been engaged in active flying since April, 1946.

TRANSPORT COMPANIES

There are no Ceylonese air transport companies engaged in air services, but the Government's external air transport plan includes the early inauguration of services to India and the United Kingdom.

An R.A.F. Transport Command service calls at Colombo on its westbound flight from Singapore to U.K. The east-bound flight is staged through Karachi and Calcutta without a call in Ceylon.

INTERNATIONAL TRANSPORT COMPANY

The following company operates services to and from Ceylon:—

Air-India, Ltd. (formerly Tata Air Lines).

AIRPORT

COLOMBO (Ratmalana). The pre-war civil airport, now handed back by the Services to the civil authorities. It is the terminal Airport for Ceylon/India traffic. Lat 6°49'N., Long. 79°39'E. 9 miles to the S. of Colombo Harbour. 15 ft. above mean sea level. Grass landing area of 700 yds. × 700 yds. suitable for light and medium aircraft and a bitumen-surfaced runway N.E.-S.W., 1,800 yds. in length, approved for medium and medium-heavy types. The aerodrome is serviceable at all seasons. Normal facilities, *e.g.* Customs, hangars, workshop, refuelling, etc. are available.

Arrangements are in hand for taking over and improving the aerodromes at Puttalam, Minneriya, Vavuniya and other airfields built during wartime as they are released by the Services authorities. These will be used for a limited freight and air-taxi services in due course.

FIJI ISLANDS

Civil Aviation in the Fiji Islands comes under the jurisdiction of the Colonial Secretary's office, Suva.

The New Zealand Government has undertaken to be responsible for the construction, staffing and maintenance work connected with the establishment of an international airport, the cost of which is to be borne equally by Great Britain, Australia and Canada.

The new airport will be situated at Nausori, about 15 miles from Suva and on the site of a small airfield which was used by the Royal New Zealand Air Force during the war.

A second Fijian aerodrome is located at Nandi, on the island of Viti Levu and about 100 miles from Suva. This was built during the war by the U.S. forces and was used mainly as a staging post on the trans-Pacific routes operated by the U.S.A.A.F. Transport Command and the Naval Air Transport Service.

In 1945-46 the R.N.Z.A.F. was maintaining air communication between New Zealand and the Pacific islands, using airfields at Apia (Samoa), Aitutaki and Rarotonga (Cook Is.), Tonga, Suva (Fiji Is.) and Norfolk Island, which were built and used by the R.N.Z.A.F. during the war. Mails are carried and under special conditions permission can be obtained for civilians to use the services.

GIBRALTAR

The airport built at Gibraltar during the war is now available for civil use and British European Airways operate a regular service twice weekly from London, via Bordeaux and Madrid. The Colonial Secretary is responsible for the administration of civil aviation matters in the colony.

AIRPORT

GIBRALTAR (North Front). Lat 36°08'N., Long. 05°20'W. The single runway E. by N. × W. by S. is 1,840 yds. long by 50 yds. wide. It is situated to the N. of the rock and part of it is built on reclaimed land.

GAMBIA

ADMINISTRATION

Civil Aviation in West Africa comes under the control of the West African Air Transport Authority, the Chairman of which is the Governor of Nigeria, with Headquarters in Lagos.

At the time of writing Civil Aviation in Gambia was in the transitional stage. The main airport was under R.A.F. control pending transfer to civil administration, and the marine base was operated by the British Overseas Airways Corporation on behalf of the Government.

INTERNATIONAL TRANSPORT COMPANIES

The following airlines operate regular services to and through Gambia:—

British Overseas Airways Corporation.
British South American Airways.
West African Airways Corporation.
Air France.

AIRPORT

YUNDUM (Bathurst). Operated by R.A.F. Situated 7 miles S.W. of Bathurst, and 19 miles by road. 86 ft. above mean sea level. Two metal-tracked runways N.E.-S.W. and S.S.E.-N.N.W. 6,000 ft. × 150 ft. Full facilities available. Overnight accommodation 17 miles from base.

SEAPLANE BASE

MARINE BASE (Half Die). Operated by B.O.A.C. for the Gambian Government. Situated in the mouth of the Gambia River and S.E. of the town of Bathurst. Alighting area 3 miles × 2 miles. Maximum depth 20 ft. Full facilities available. Overnight accommodation 11 miles from base.

GOLD COAST

ADMINISTRATION

Civil Aviation in British West Africa is now under the control of the West African Air Transport Authority which consists of the four Governors of Nigeria, the Gold Coast, Sierra Leone and the Gambia. The Chairman is the Governor of Nigeria and any inquiries should be addressed to the Chief Secretary to the Government of Nigeria, the Secretariat, Lagos, Nigeria.

Each Colony has a local Controller of Civil Aviation. In the Gold Coast, the Controller is the Director of Public Works, the Public Works Department, Accra. The maintenance and operation of civil airfields is undertaken direct by the various Government Departments concerned.

INTERNATIONAL TRANSPORT COMPANIES

The following companies operate services to and through the Gold Coast:—

The British Overseas Airways Corporation.
S.A.B.E.N.A.
Air France.

AIRPORT

ACCRA. Has been designated as an international Airport, and is intended to be the main terminal airport of the Gold Coast. Lat. 5°36'N., Long. 0°10'W. 5 miles N.E. of Accra Harbour. 200 ft. above sea level. Three runways 2,400 yds. × 150 yds., 1,450 yds. × 150 yds., 1,000 yds. × 150 yds.

BRITISH COMMONWEALTH—GOLD COAST—*continued*.

with 100 ft. wide taxying strips. All tarred surfaces fit for all weather conditions. Minor repair facilities are available. Night-landing facilities are provided by rotating electric beacon. High frequency direction finder. Telephone, teletype and telegraph facilities are at the airfield.

In addition to Accra, Takoradi airfield is still open to civil aircraft though this airfield may be abandoned shortly in which case it will revert to the status of an emergency landing ground.

Emergency landing fields are maintained at Kumasi and at Tamale, and in addition there are wartime emergency landing fields at Wa, Navrongo, Yendi and Kete Krachi in the Northern Territories. These were constructed during the war but are no longer maintained in use.

GRENADA

Civil Aviation in Grenada comes under the jurisdiction of the Government Office, Grenada.

INTERNATIONAL TRANSPORT COMPANIES

The following company operates regular services to and through Grenada :—

British West Indian Airways, Ltd.

AIRPORT

PEAL AIRFIELD. All-weather Government-owned airfield in the Province of St. Andrews, on the N.E. coast of Grenada. Lat. 12°09′N., Long. 61°35′W. Altitude 1-50 ft. above mean sea level. One runway S.W.-N.E. 5,200 ft. × 250 ft. bitumenised surface plus 25 ft. drains on either side.

JAMAICA

ADMINISTRATION

Civil Aviation is subject to Air Navigation Directions issued by the Governor under Article 30 of the Air Navigation (Colonies, Protectorates and Mandated Territories) Order, 1927.

Civil Aviation activities are supervised, generally, by the Civil Aviation Committee under the Chairmanship of the Director of Public Works. This Committee acts in an advisory capacity to the Government on all matters pertaining to Civil Aviation in the Colony.

There are, at present, no Flying Clubs, Gliding Clubs, nor Flying Schools in the Colony.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating to and through Jamaica.

Pan American World Airways, (U.S.A.).
Royal Dutch Airlines (K.L.M., West Indies Division).
British West Indian Airways.

AIRPORTS

KINGSTON (Palisadoes). Lat 17°56′N., Long. 76°47′W. Altitude 4 ft. Runways E.-W. 1,333 yds. × 50 yds., S.E.-N.W. 1,766 yds. × 50 yds. A Customs Airport, owned and operated by the Government of Jamaica.

MONTEGO BAY. Owned by the Government of Jamaica. Not yet completed and regarded as an emergency landing field.

KENYA

ADMINISTRATION

The Kenya Government is responsible for the administration of Civil Aviation.

TRANSPORT COMPANIES

East African Airways Corporation.

Head Office: Rhodes House, Delamere Avenue, Nairobi.

Principal Officials: Sir Charles Lockhart, C.B.E. (Chief Secretary to the East African Governor's Conference). Chairman: Sir Reginald E. Robbins, C.M.G., O.B.E. (General Manager, Kenya Uganda Railways and Harbours), Sir Alfred Vincent (Leader of the Unofficial Members of Legislative Council, Kenya), E. C. Phillips and H. R. Fraser (Members of the Legislative Council, Kenya) and George Baldwin (Manager, South Africa, B.O.A.C.).

Aircraft used:—Seven D.H. Rapide. Three D.H. Doves are on order.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating regular services to and through Kenya Colony :—

British Overseas Airways Corporation
Central African Airways Corporation
South African Airways
Air-France

MALAYA

Civil Aviation in the Malayan Union and Singapore Colony is administered by the Director of Civil Aviation, Singapore.

FLYING CLUBS

The Royal Singapore Flying Club.
Address: Singapore.

The Penang Flying Club.
Address: c/o. Evatt & Co., Chartered Bank Chambers, Penang.

The Perak Flying Club.
Address: c/o. Evatt & Co., Ipoh, Perak.

The Kuala Lumpur Flying Club.
Address: 12, Market Street, Kuala Lumpur.

TRANSPORT COMPANY

Malayan Airways, Ltd.

Head Office: Singapore.

This company is financed jointly by the Straits Steamship Co. of Singapore, and the Ocean Steamship Co. of Liverpool.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating scheduled services to and through Malaya :—

British Overseas Airways Corporation.
Qantas Empire Airways.
K.L.M.

AIRPORT

SINGAPORE (Kallang). State-owned combined landplane and seaplane base with all facilities.

MALTA

Administration of civil aviation in Malta is the responsibility of the Secretary to the Government, Valetta, Malta.

Instone Air Lines 1946 (Malta), Ltd., which has been formed by S. Instone & Co., Ltd. the shipping company, is planning to operate a passenger and freight air service, in co-operation with the British Overseas Airways Corpn., between the United Kingdom and Malta. S. Instone & Co., Ltd., one of the pioneers of British air transport, formed the Instone Air Line in 1919, and this company was merged with others to form Imperial Airways (the predecessor of B.O.A.C.) in 1924.

British Aviation Services (Malta), Ltd., operates feeder and charter services from the Luga airport.

AIRPORT

MALTA (Luqa). Lat. 35°51′N., Long. 14°29′E. Altitude above sea level 250 ft. Runways N.-S. 834 yds. × 50 yds., N.E.-S.W. 2,000 yds. × 50 yds., E.-W. 1,000 yds. × 50 yds., S.E.-N.W. 1,776 yds. × 50 yds.

NIGERIA

ADMINISTRATION

Civil Aviation in Nigeria comes under the jurisdiction of the West African Air Authority, which consists of representatives of the Governments of Nigeria, Gold Coast, Sierra Leone and the Gambia. Civil Aviation is locally under the jurisdiction of the Director of Public Works, who is also Controller of Civil Aviation.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating scheduled services to and through Nigeria :—

British Overseas Airways Corporation
Headquarters: Airways House, Marina, Lagos.

Société Anonyme Belge d'Exploitation de la Navigation Aérienne (SA.B.E.N.A.).
Local Agents: B.O.A.C., Lagos.

Air France.
Address: Air France, Lagos.

AIRPORTS

Full particulars of all Nigerian aerodromes are given in the official publication entitled *Aerodrome Plans and other particulars as at September* 1, 1944.

BRITISH COMMONWEALTH—*continued.*

NORTHERN RHODESIA

ADMINISTRATION

The passing of the Central African Air Services Act of 1946 set up a Central African Air Authority which is responsible for the promotion of progress and development of air services in Central Africa, namely Northern Rhodesia, Southern Rhodesia and Nyasaland. It has been established jointly by these territories and its powers apply therein. For composition of the Authority see "Southern Rhodesia."

INTERNATIONAL TRANSPORT COMPANIES

The following companies operate services to and through Northern Rhodesia:—

British Overseas Airways Corporation

The B.O.A.C. service from Cairo to Givelo (Southern Rhodesia) calls at Kasama thrice weekly.

Central African Airways Corporation (formerly Southern Rhodesian Air Services).

AIRPORTS

LUSAKA. Lat. 15°25′S., Long. 28°18′E. On East side of town. Alt. 4,320 ft. Runways E./W. 1,200 yds. N.E./S.W. 1,100 yds. N./S. 1,100 yds. N.W./S.E. 1,100 yds.

BROKEN HILL. Lat. 14°28′S., Long. 28°27′E. On South side of town. Alt. 3,800 ft. Area 1,250 × 1,000 yds.

FORT JAMESON. Lat. 13°33′S., Long. 32°36′E. 7 miles N.W. of town. Alt. 3,620 f.. Runways E./W., N./S., N.E./S.W. N.W./S.E. each 1,000 × 150 yds.

M'PIKA. Lat. 11°52′S., Long. 31°27′E. 3½ miles S.S.W. of town. Alt. 4,778 ft. Area 1,450 × 1,250 yds.

LIVINGSTONE. Lat. 17°53′S., Long. 25°51′E. 2½ miles S.S.W. of town. Alt. 2,950 ft. Area 1,160 × 830 yds.

For details of other landing grounds in Northern Rhodesia reference should be made to the *Air Pilot of Northern Rhodesia* obtainable from the Director of Civil Aviation, Salisbury, Southern Rhodesia. Price 12/-.

NYASALAND

ADMINISTRATION

Civil Aviation in Central Africa is under the jurisdiction of the Central African Air Authority, which has been established jointly by the territories of Northern and Southern Rhodesia and Nyasaland. For forther details see "Southern Rhodesia."

Civil Aviation in Nyasaland is controlled locally by the Registrar of Aircraft, Directorate of Public Works, Zomba.

TRANSPORT COMPANY

The following company operates scheduled services to and through Nyasaland:—

Central African Airways Corporation (formerly Southern Rhodesian Air Services).

AIRPORTS

CHILEKA. (Blantyre). Lat. 15°42′S., Long. 34°58′E. 7 miles N.N.W. of Blantyre. Alt. 2,400 ft. Area 1,000 × 600 yds.

ZOMBA. Lat. 15°24′S., Long. 35°23′E. 3 miles E.N.E. of town. Alt. 2,550 ft. Area 1,000 × 900 yds.

LILONGWE. Lat. 13°59′S., Long. 33°47′E. North side of town. Alt. 3,600 ft. Area 1,000 × 1,000 yds.

LUCHENZA. Lat. 16°00′S., Long. 35°20′E. Adjacent to Luchenza Rly. Stn. Alt. 2,300 ft.

There are also landing grounds at:

CHIKWAWA. Lat. 16°03′S., Long. 34°49′E. Alt. 127 ft.
ZOMBWE. Lat. 11°26′S., Long. 33°50′E. Alt. 4,000 ft.
DEDZA. Lat. 14°21′S., Long. 34°21′E. Alt. 5,250 ft.
KOTO KOTO. Lat. 13°00′S., Long. 34°17′E. Alt. 1,800 ft.
MZIMBA. Lat. 11°54′S., Long. 33°56′E. Alt. 4,500 ft.
LIVINGSTONIA. Lat. 10°37′S., Long. 34°08′E. Alt. 3,600 ft.
LODJWA. Lat. 12°21′S., Long. 33°37′E. Alt. 4,800 ft.
FORT HILL. Lat. 9°40′S., Long. 33°08E. Alt. 4,000 ft.

For further details of aerodromes reference should be made to *Air Pilot of Southern Rhodesia and Nyasaland*, obtainable from the Director of Civil Aviation, Salisbury, Southern Rhodesia. Price 12/6.

NEWFOUNDLAND

ADMINISTRATION

The Civil Aviation Division, Gander, Newfoundland, falls within the Department of Public Works under the Commissioner for Public Utilities, St. John's, Nowfoundland.

Commissioner for Public Utilities: Hon. J. S. Neill.
Director of Civil Aviation: H. A. L. Pattison.

INTERNATIONAL TRANSPORT COMPANIES

There are no Newfoundland Air Transport undertakings at present. International Companios operating to or through Newfoundland includo the following:—

Trans-Canada Airlines.
British Overseas Airways Corporation.
Pan American World Airways.
Transcontinental and Western Air, Inc. (Trans World Airline).
American Overseas Airlines.
Air France.
Svensk Interkontinental Luftraffik A.B. (S.I.L.A.).
Royal Dutch Airlines (K.L.M.). (In Summer only).

AIRPORT

NEWFOUNDLAND AIRPORT (Gander). The only Airport in Newfoundland licensed for civil use. Lat. 48°57′N., Long. 54°34′W. 493 ft. above sea level. Four paved runways with magnetic headings as follows: 320°-140° 6,000 ft × 400 ft., 180°-360° 6,000 ft. × 400 ft., 090°-270° 6,000 ft. × 400 ft., 230°-050° 4,500 ft. × 600 ft. The Airport has all facilities, Radio, Meteorological office, Navigational Aids, etc.

The Botwood baso used by Pan American Airways, American Export Airlines and British Overseas Airways for their trans-Atlantic flying-boat services became inoperative in October, 1945, with the conversion of all trans-Atlantic services from flying-boats to landplanes.

The Torbay Airport, on the outskirts of St. John's, was built and used by the R.C.A.F. during the war. The land comprising the airport has been granted to Canada in fee simple and it is now being operated as a civil airport by the Canadian Department of Transport. It serves as the St. John's terminal for Trans-Canada Air Lines' local services.

Other airports include Harmon Field, Stephenville, a U.S. Army field on territory leased to the U.S. for Atlantic defence and used by U.S.A.A.F. Air Transport Command; Argentia, a U.S. Navy field leased on similar terms; and an emergency landing strip at Buchans operated by the Canadian Department of Transport.

PALESTINE

(British Mandate)

ADMINISTRATION

Civil Aviation in Palestine is controlled by the Directorate of Civil Aviation, Mamillah Road, Jerusalem.

The Palestine Government has formed a Palestinian Air Transport Organization, to be run either by the Government or by a local statutory corporation. This organization will enjoy a monopoly in local air services.

INTERNATIONAL TRANSPORT COMPANIES

Misr Airwork S.A.E. (Egypt).
Middle-East Airlines (Lebanon).
Iraq Airways (Iraq).
TWA-Trans World Airline (U.S.A.).

AERODROMES

There are aerodromes at GAZA, HAIFA, JERICHO, LYDDA, RAMLEH, SEMAKH and seaplano stations at HAIFA and TIBERIAS.

ST. KITTS - NEVIS

Civil Aviation in St. Kitts and Nevis is under the jurisdiction of the office of the Colonial Secretariat of the Leeward Islands, Antigua.

INTERNATIONAL TRANSPORT COMPANIES

The following companies oporato to and through St. Kitts-Nevis:—

British West Indian Airways, Ltd.
Royal Dutch Airlines (K.L.M.).
Caribbean-Atlantic Airlines, Inc. (non-schedulod).

AIRPORT

GOLDEN ROCK AIRFIELD. Government owned and maintained Class C aerodrome on the island of St. Kitts, 1¼ miles N.E. of Basseterre. Lat. 17°19′N., Long. 61°32′W. Altitude 142 ft. above sea level. Single metalled runway 4,124 ft. long × 150 ft. wide with 75 ft. grass shoulders on either side. Direction of runway 61°32′E. from true N. No hangers or repair facilitios. Fuel and oil. No night flying facilities. Radio operated by British West Indian Airways.

BRITISH COMMONWEALTH—*continued.*

SIERRA LEONE

ADMINISTRATION

Civil Aviation in Sierra Leone is under the control of the West African Air Transport Authority, which consists of the Governors of Nigeria, Gold Coast, Sierra Leone and the Gambia. There is a local Controller of Civil Aviation with headquarters at Freetown.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating to and through Sierra Leone :—

British Overseas Airways Corporation
Air-France.

AIRPORT

WATERLOO AIRPORT. 23 miles from Freetown. W/T, etc. available. The alternative airport at Lungi, Sierra Leone Protectorate, is not in regular use.

SOUTHERN RHODESIA

ADMINISTRATION

Civil Aviation in Southern Rhodesia is administered by the Department of Civil Aviation, P.O. Box 1379, Salisbury, Southern Rhodesia. Minister of Civil Aviation: Col. the Hon. Sir Ernest Guest, K.B.E., M.P. Director of Civil Aviation: Air Vice-Marshal C. W. Meredith, C.B., C.B.E., A.F.C.

Recent legislation has provided for a Central African Air Authority, which in effect is an Operator's Licensing Board, but is also charged to :—

(*a*) Keep under review and promote progress and development of air services in Central African territories: namely Southern Rhodesia, Northern Rhodesia and Nyasaland.

(*b*) Exercise supervision and control over the Central African Airways Corporation.

The Authority has been established jointly by the Central African Territories and its powers apply to those territories.

The Central African Air Authority.

Address: P.O. Box 1379, Salisbury, Southern Rhodesia.

Members: The Minister for Defence and Air, Southern Rhodesia (Chairman), the Chief Secretary to the Government of Northern Rhodesia: Ralph J. Morton, M.C., K.C. (appointed by the Government of Southern Rhodesia), and Charles Mathew, K.C. (appointed by the Government of Nyasaland).

FLYING CLUBS

Salisbury Flying Club. Address: P.O. Box 675, Salisbury. Aerodrome: Belvedere Airport, Salisbury.

Gatooma Flying Club. Address: P.O. Box 114, Gatooma. Aerodrome: Gatooma Aerodrome.

Midlands Flying Club. Address: P.O. Box 63, Gwelo. Aerodrome: Moffat Aerodrome, Gwelo.

Bulawayo Light Plane Club. Address: 5, Ludlow Hewitt Road, Bulawayo. Aerodrome: Kumalo Airport, Bulawayo.

Victoria Flying Club. Address: P.O. Box 124, Port Victoria. Aerodrome: Port Victoria Aerodrome.

TRANSPORT COMPANY

Central African Airways Corporation (formerly Southern Rhodesian Air Services).

Head Office: P.O. Box 1319, Salisbury.

Chairman of Board of Management: Air Vice-Marshal C. W. Meredith, C.B., C.B.E., A.F.C.

General Manager: D. D. Longmore.

Equipment: D.H. 89 Rapide and Avro Anson. (D.H. Doves and Vickers Vikings on order).

INTERNATIONAL TRANSPORT COMPANIES

The following company is operating to and through Southern Rhodesia :—

South African Airways.
British Overseas Airways Corporation.
S.A.B.E.N.A. (Belgium Congo).

AIRPORTS

SALISBURY (Belvedere). Lat. 17°50′S., Long. 31°01′E. 2 miles S.W. of Salisbury town. Altitude 4,780 ft. Main strip 086-266° (M), length 2,300 yds., secondary strip 140-320° (M), length 1,200 yds. Grass covered. Asphalt and cement consolidated taxi track, take-off strips and hard standing. Refuelling facilities. Limited repair and housing of aircraft.

KUMALO. Lat. 20°08′S., Long. 28°38′E. Altitude 4,480 ft. Main strip 120-300° (M), length 1,700 yds., secondary strips 0-180° (M), length 2,000 yds. and 90-270° (M), length 1,900 yds. No grass. Asphalt and cement consolidation. Refuelling facilities. Limited repair and housing facilities.

The above are the two principal airports in the territory. For details of the remaining airfields reference should be made to the *Air Pilot of Southern Rhodesia.*

TANGANYIKA TERRITORY

ADMINISTRATION

Civil Aviation is administered by the Department of Civil Aviation, Dar-es-Salaam.

TRANSPORT COMPANY

East African Airways Corporation.

This corporation operates scheduled services serving Tanganyika Territory.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating regular services to and through Tanganyika Territory :—

British Overseas Airways Corporation.
Central African Airways.
Air-France.

OTHER OPERATING COMPANIES

The Lands and Mines Department, Tanganyika Government, operates an Avro Anson on air-survey duties. These operations are controlled by the Director of Civil Aviation, Dar-es-Salaam.

PUBLICATIONS

The Air Pilot of Tanganyika Territory. Published by the Department of Civil Aviation, Dar-es-Salaam, price 12/6 net.

AIRPORTS

MOSHI. Lat. 3°22′S., Long. 37°19′E. Altitude above mean sea level 2,70a0 ft Direction and length of runways: N.-S. 1,750 yds. × 100 yds., E.-W. 1,550 yds. × 100 yds., N.N.W.-S.S.E. 1,000 yds. × 100 yds.

DAR-ES-SALAAM. Lat. 6°52′S., Long. 39°16′E. Altitude above mean sea level 105 ft. Direction and length of runways: N.-S. 1,767 yds. × 200 yds., N.W.-S.E. 2,020 yds. × 200 yds.

LINDI. Lat. 9°50′S., Long. 39°47′E. Altitude above mean sea level 100 ft. Direction and length of runways: N.N.E.-S.S.W. 1,767 yds. × 200 yds., N.W.-S.E. 2,020 yds. × 200 yds., E.-W. 1,513 yds. × 200 yds.

TABORA. Lat. 5°05′S., Long. 32°50′E. Altitude above mean sea level 3,875 ft. Direction and length of runways: W.S.W.-E.N.E. 2,033 yds. × 200 yds., N.E. 1,700 yds. × 200 yds.

MBEYA. Lat. 8°55′ S., Long. 33°28′E. Altitude above mean sea level 5,600 ft. Direction and length of runways: W.S.W.-E.N.E. 1,350 yds. × 66 yds., N.W.-S.E. 1,480 yds. × 70 yds., N.N.W.-S.S.E. 1,153 yds. × 35 yds.

TANGA. Lat. 5°06′S., Long. 39°04′E. Altitude above mean sea level 160 ft. Direction and length of runways: N.-S. 1,175 yds. × 200 yds., N.W.-S.E. 1,660 yds. × 200 yds., N.E.-S.W. 1,600 yds. × 200 yds.

DODOMA. Lat. 6°11′S., Long. 35°45′E. Altitude above mean sea level 3,670 ft. Direction and length of runway: E.-W. 1,600 yds.

MWANZA. Lat. 2°28′S., Long. 32°55′E. Altitude above mean sea level 3,740 ft. Direction and length of runways: N.W.-S.E. 1,000 yds., S.W.-N.E. 1,250 yds., S.S.W.-N.N.W. 900 yds.

TRINIDAD

ADMINISTRATION

Civil Aviation is administered by the Government of Trinidad and Tobago through the office of the Director of Civil Aviation, 80, Abercromby Street, Port of Spain. Director of Civil Aviation and Airport Superintendent: Wing Cdr. Maurice Banks.

The Public Works Department is responsible for the maintenance and repair of runways and roads leading to airports, drainage, maintenance and repair of airport builidngs, etc.

TRANSPORT COMPANY

British West Indian Airways

Head Office: 12, Abercromby Street, Port of Spain, Trinidad.

This company is associated with British South American Airways.

Aircraft: Five Lockheed Lodestar, two Lockheed Hudson (withdrawn from scheduled service Summer of 1946) and one Lockheed 12A.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating to and through Trinidad :—

Pan American World Airways.
K.L.M. (West Indies Division).

BRITISH COMMONWEALTH—TRINIDAD—*continued.*

FLYING CLUBS

Light Aeroplane Club of Trinidad and Tobago. Address: 68, Marine Square, Port of Spain, Trinidad. Patron: H. E. Sir Bede Clifford. Chairman: A. J. Ruthven-Murray.

AIRPORTS

Piarco Airport. Class I Customs Airport in the County of St. George, 14¾ miles S.E. of Port of Spain. Lat. 10°35′N., Long. 61°21′W. Altitude 37 ft. Runways: E.-W. 5,000 ft. × 200 ft., N.E.-S.W. 2,400 ft. × 9 ft., N.W.-S.E. 2,400 ft. × 90 ft., all asphalt surface. Full facilities including night lighting. Radio beacon and D/F by arrangement with Pan American Airways and R.A.F. Transport Command.

Cocorite. Class I Customs Marine Base operated by B.O.A.C. on behalf of the Trinidad Government. 3 miles W.N.W. from the centre of Port of Spain. Lat. 10°4′N., Long. 61°33′ W. Pan American Airways facilities have been withdrawn and with suspension of the B.O.A.C. trans-Atlantic flying-boat service (which used Cocorite on winter service) the base was due to close down after mid-1946.

Crown Point. Class II Customs Airport on S.W. tip of the island of Tobago. Lat. 11°08′ N., Long. 60°50′ W. Altitude 10 ft. Runway: E.-W. 5,000 ft. × 250 ft., grass-grown on coral base. No hanger, light repair facilities or fuel. Used by British West Indian Airways.

UGANDA

ADMINISTRATION

The Uganda Government is at present responsible for the administration of Civil Aviation. The Director of Public Works, Entebbe, is the Registrar of Aircraft. Aircraft are required to arrive at and depart from Entebbe Airport unless prior permission for other operations has been obtained.

INTERNATIONAL TRANSPORT COMPANIES

The following companies operate services to and through Uganda:—

British Overseas Airways Corporation.
East African Airways Corporation.

AIRPORT

Entebbe. Lat. 00°05′N., Long. 32°28′E. 25 miles from Kampala. 3,750 ft. above sea level. Two runways N.-S. 1,810 yds. long., N.W.-S.E. 2,000 yds. long (under construction) D/F Station. Weather service. Telephone. Hotel and garages at Kampala.

SEAPLANE BASE

Port Bell. Lat. 00°02′N., Long. 32°35′E. 9 miles from Kampala. Seaplane alighting area on Lake Victoria used by B.O.A.C. 3,725 ft. above sea level. Telephone. Weather service. Hotel and garages at Kampala.

LANDING GROUNDS

There are landing grounds for light aircraft in fair weather at Tororo, Soroti, Moroto, Lira, Gulu, Arua, Masindi and Mbarara. These are all administrative centres but facilities are very limited and fuel, etc. can only be obtained by prior arrangement with the oil companies in Kampala.

INDIA AND BURMA

ADMINISTRATION

Civil Aviation in India is under the control of the Department of Posts and Air, New Delhi.

Director-General of Civil Aviation: Sir Frederick Tymms, C.I.E., M.C., F.R.Ae.S.

Deputy Director-General, Airways and Administration: W. H. Watt, O.B.E.

Deputy Director-General, Aircraft Operations: Air Vice-Marshal Sir Edward Rice, K.C.B., C.B., M.C.

In order that post-war air transport services in India may proceed on a rational and economic basis, the Indian Aircraft Act, 1934 has been amended. Previously this Act contained no specific provision for controlling and regulating development. In February, 1944 a Bill introducing the Indian Aircraft (Amendment) Act, 1944, takes care of this by the insertion of two clauses, (aa) and (ab) to sub-section (2) of section 5 of the 1934 Act.

A programme of post-war development involving a construction cost of some £12,000,000 is planned for Indian air services. An Air Transport Licensing Board is to be formed and a system of controlled subsidy, probably limited to routes of national importance, will be instituted. Development will be left mainly to private enterprise, although operations will probably be restricted to a limited number of companies.

ASSOCIATION

Aero Club of India and Burma, Ltd. Patron-in-Chief: The Viceroy and Governor-General of India H. E. Field Marshal Lord Wavell, P.C., G.C.B., G.S.C.I., G.C.I.E., C.M.G., M.C. President: H.E. the Commander-in-Chief. Vice-President: The Hon. Sir Maneckji Dababhoy, K.C.I.E., K.C.S.I. Chairman: Mr. P. R. Pinhorn.

FLYING CLUBS

Bengal Flying Club, Ltd. President: Mr. A. N. Chaudhuri. Hon. Secretary: Mr. S. P. Ray.

Bihar Flying Club. Headquarters: Patna. President: Hon. Mr. Justice H. R. Meredith. Secretary: Mr. Mohammed Yunus.

Bombay Flying Club, Ltd. President: Sir Homi Mehta, K.B.E., J.P. Hon. Secretary: Mr. J. R. Taleyarkhan.

Central Provinces and Berar Flying Club. Headquarters: Nagpur. President: Sir Hari Singh Gour. General Hon. Secretary: Mr. E. C. Eduljee.

Delhi Flying Club, Ltd. President: Dr. W. M. Smith.

Hyderabad State Aero Club. General Manager: Mr. J. N. Nanda. Secretary: Mr. Baber Mirza.

Jodhpur Flying Club. President: The Maharajah Sahib Bahadur.

Karachi Aero Club, Ltd. President: Shivji V. Kothari, J.P. Hon. Secretary: G. Grossenbacher.

Madras Flying Club, Ltd. Chairman: K. R. Simpson. Hon. Secretary: Mr. R. M. Steele.

Northern India Flying Club. Headquarters: Lahore. President: The Hon. Rai Bahadur Lala Ram Saran Dass. Hon. Secretary: Dr. J. B. Sproull.

The United Provinces Flying Club, Ltd. Headquarters: Cawnpore. Branch: Lucknow. President: R. F. Mudie, Esq., C.S.I., C.I.E., O.B.E., I.C.S. Hon. General Secretary: J. M. Heeramaneck.

PUBLICATIONS

Indian Aviation. Founded 1925. Published monthly by Thorne's Ltd. Price 8 annas. Editorial Offices: 13, Ezra Mansions. P.O. Box 2361, Calcutta.

TRANSPORT COMPANIES

Air-India, Ltd.

Head Office: Bombay House, Bruce Street, Bombay.

Chairman: J. R. D. Tata. General Manager: B. W. Figgins. Air Superintendent: A. C. Gazdar. Traffic Superintendent: S. K. Kooka. Operations Superintendent: B. K. Rao. Chief Pilot: D. N. Bunsha.

Formerly known as Tata Air Lines, this company was established in 1946 with an authorised capital of £3,750,000. It holds the Trans-World Airline agency in India and has a service agreement with that company.

Equipment includes ten Douglas DC-3, two Douglas DC-2, and three Beechcraft Expediter.

Deccan Airways, Ltd.

Head Office: Bashir Bagh Road, Hyderabad.

Chairman: J. N. Nanda. Directors: Nawab Mir Nawaz Jung Bahadur, B. W. Figgins, and Mir Laik Ali. General Manager: Air Commodore H. A. Fenton, C.B.E., D.S.O., D.F.C.

This company is affiliated to Air-India Ltd. Its policy is controlled by the Hyderabad Government, who, with the State Railway, own the majority of the shares. The company acts as technical adviser to the Hyderabad State Aero Club.

Equipment includes four Douglas C-47 and one D.H. 89. Three D.H. Dove aircraft are on order.

Indian National Airways.

Head Office: Scindia House, Connaught Curcus, New Delhi.

Chairman: Sir Homi Mehta. Directors: J. P. Massey, Sir Shri Ram, Rai Bahadur Lala Gopaldas, A. H. Bhiwandiwalla, A. Duguid, G. H. Heape, M. A. Ispahani, Rao Bahadur Rao Raja Narpat Singh and N. R. Sarkar. General Manager: W. Bradshaw. Operations Manager: Biren Mukerji. Traffic Manager: J. A. Fleming.

This company has an authorised capital of 10,000,000 Rupees and holds 25% of the share capital of Indian Trans-Continental Airways (at present inactive). The company is in charge of the commercial and traffic organisation of B.O.A.C. in India.

Equipment includes eight Douglas C-47, four D.H. 89, four Beechcraft. Delivery of six Vickers Vikings should be complete by the end of 1946.

Orient Airways, Ltd.

Head Office: Calcutta.

Formed to operate services within India and from Calcutta to Rangoon and to Kabul, Afghanistan. Has bought four DC-3s from Pan American Airways, and has ordered a number of Consolidated Vultee 240 airliners for delivery in 1947.

INTERNATIONAL TRANSPORT COMPANIES

The following international air transport companies are operating routes to and through India.

Air France (France).
British Overseas Airways Corporation (Great Britain).
China National Aviation Corporation (China).
K.L.M. (Netherlands).
Qantas-Empire Airways (Australia).
T.W.A. Trans World Airlines (U.S.A.).

BRITISH COMMONWEALTH—INDIA AND BURMA—*continued.*

CUSTOMS AIRPORTS

KARACHI (Drigh Road). Lat. 24°53′N., Long. 67°07′E. Altitude 20 ft. Runways: N.E.-S.W. 1,700 yds. × 50 yds., E. by N.-W. by S. two parallel runways 1,500 yds. × 50 yds. and 2,000 yds. × 50 yds.

CALCUTTA (Dum Dum). Lat. 22°39′N., Long. 88°27′E. Altitude 14 ft. Runway: N.-S. 2,500 yds. × 50 yds.

BOMBAY (Juhu). Lat. 19°06′N., Long. 72°50′E. Altitude 9 ft. Runways: E.N.E.-W.S.W. 1,300 yds. × 50 yds., N.N.E.-S.S.W. 800 yds. × 50 yds., S.S.E.-N.N.W. 800 yds. × 50 yds.

BOMBAY (Santacruz). Lat. 19°05′N., Long. 72°52′E. Altitude 10 ft. Runways: N.E.-S.W. 2,000 yds. × 50 yds., E.-W. 1,750 yds. × 50 yds., S.E.-N.W. 1,750 yds. × 50 yds.

MADRAS (St. Thomas' Mount). Lat. 13°00′N., Long. 80°12′E. Altitude 40 ft. Runways: N.-S. 1,100 yds., E.N.E.-W.S.W. 2,000 yds., S.E.-N.W. 1,600 yds.

TRICHINOPOLY. Lat. 10°46′N., Long. 78°43′E. Altitude 290 ft. Runways: E.-W. 2,400 yds. × 50 yds., S.S.E.-N.N.W. 1,600 yds. × 50 yds.

AHMEDABAD. Lat. 23°04′N., Long. 72°38′E. Altitude 180 ft. Runways: N.E.-S.W. 2,000 yds. × 50 yds., S.E.-N.W. 1,600 yds. × 50 yds.

KARACHI (Maunipur Road). Lat. 24°54′N., Long. 66°57′E., Altitude 55 ft. Runways: N.E.-S.W. 2,000 yds. × 50 yds., E.-W. 2,000 yds. × 50 yds.

CHITTAGONG. Lat. 22°16′N., Long. 91°49′E. Altitude 12 ft. Runways: N.E.-S.W. 2,000 yds. × 50 yds., S.E.-N.W. 1,800 yds. × 50 yds.

VIZAGAPATAM. Lat. 17°43′N., Long. 83°14′E. Altitude 12 ft. Runways: N.E.-S.W. 2,000 yds. × 50 yds., E.-W. 1,600 yds. × 50 yds., N.-S. 930 yds. × 50 yds.

SEAPLANE CUSTOMS HARBOURS

CALCUTTA (Willingdon Reach). Lat. 22°39N., Long. 88°21′E.
KARACHI (Harbour). Lat. 24°50′N., Long. 66°58′E.
KARACHI (Korangi Creek). Lat. 24°47′N., Long. 67°08′E.

2—SELF-GOVERNING DOMINIONS

DOMINION OF CANADA

ADMINISTRATION

Civil Aviation in Canada is controlled by the Civil Aviation Department of the Department of Transport.

Civil Aviation Division, Department of Transport, Ottawa, Ont.
Controller of Civil Aviation: A. D. McLean.

Air Regulations Department.
Superintendent: S. Graham.

The duties of this department include the inspection and registration of aircraft and their certification for airworthiness; the examination and licensing of pilots and air engineers; supervision of flying clubs; prevention of dangerous flying; inquiries into the cause of aircraft accidents; and international flying.

Airways and Airports Department.
Superintendent of Airways: R. Dodds.
Chief Airways Construction Engineer: F. C. Jewett.
Chief Illumination Engineer: H. Ainsworth.

The duties of this department include the inspection, licensing and registration of airports and seaplane bases; the construction and maintenance of airports and intermediate aerodromes, which now includes all the principal municipal airports in Canada; assistance to municipalities in the designing and constructing of municipal airports; the lighting of government airports and air routes; the development and construction of radio range sites and the erection of radio range stations with the exception of the installation of radio equipment; the construction of buildings and telephone and power lines; and the calibration and testing of radio aids to air navigation.

THE AIR TRANSPORT BOARD

Address: Room 123, No. 3, Temporary Building, Lyon Street, Ottawa.

Members of the Board: R. C. Henry (Chairman), Air Vice-Marshal Alan Ferrier, J. O. Romeo Vachon.

Chief Research Aeronautical Engineer: Dr. J. J. Green, M.B.E.

Chief, Economics Division: J. C. Lessard.
Chief, Traffic Division: A. S. Kirk.
Secretary and Legal Adviser: C. S. Booth.

The Air Transport Board has been designed not only to perform regulatory duties with respect to air traffic in Canada but is also charged with the responsibility on advising the Government on ways and means of bringing about a rapid and well-planned expansion of transport by air. The Board will be in a position to give prompt attention to all matters affecting air transport requiring governmental consideration.

The regulatory duties of the Board include the establishment of tariffs and the regulating of rates, examination of the ownership, financial structure, operations, and financial position of air carriers; the making of recommendations for needed financial assistance; and generally advising the Government on all matters relating to civil aviation and the performance of such other allied duties for which the attentions of the Board may be directed.

Creation of the Air Transport Board removes from the Board of Transport Commissioners the regulatory duties with respect to air transport which were formerly under their jurisdiction. The Department of Transport will continue to administer those portions of the Aeronautics Act and The Air Regulations which deal with civil aviation and do not come within the scope of the Air Transport Board.

ASSOCIATIONS

The Royal Canadian Flying Clubs' Association, formed in 1929 at Ottawa. Represents the *Fédération Aéronautique Internationale*. The central organization of the Canadian Light Aeroplane Clubs. Patron: Hon. President: J. A. Wilson. President: S. R. Bernardo. Treasurer: H. A. Yates. Secretary-Manager: W. G. Welstead. Address: Journal Building, Ottawa, Ont.

Zone Vice-Presidents: J. W. Humphrey (Maritime), A. S. Dawes (St. Lawrence), E. G. Storie (Central), J. R. Morgan (Mid-West), A. J. E. Sumner (Saskatchewan), W. R. May (Alberta), W. G. McKenzie (Pacific).

The Association is the parent organization of the Canadian flying clubs and is the Canadian representative of the *Fédération Aéronautique Internationale* (F.A.I.). Before the war membership comprised twenty-two active flying clubs. By the end of 1946 the number was approaching fifty.

Air Industries and Transport Association of Canada. Address: 610, Blackburn Building, Ottawa, Ontario. Directors: C. H. Dickins, M.B.E. (President), P. C. Garratt (Vice-President), H. C. Cottrell (Hon. Secretary), A. B. MacLaren (Hon Treasurer), W. N. Deisher, C. R. Leavens, D. S. Ormond, A. L. Gibson, Grant MacDonald, C. F. Pearce, C. D. Fairweather. Executive Secretary: W. B. Burchall.

National Aeronautical Association of Canada, Inc. Address: 442, Confederation Life Building, 17, Queen Street East, Toronto. President: R. W. Richards. General Manager: C. R. Patterson.

Institute of Aircraft Technicians. President: D. T. Jackson (Department of Transport, Montreal), Vice-President: H. V. Wright (Canadian Wright, Ltd.). Secretary: J. R. Chadburn.

Canadian Air Line Pilots' Association (C.A.L.P.A.). Affiliated with Air Line Pilots' Association of U.S.A. and British Air Line Pilots' Association. President: Capt. C. L. Skelding (T.C.A.). Vice-Presidents: Capt. J. F. Crosby (T.C.A.) and Capt. C. R. Robinson (C.P.A.L.). Secretary and Treasurer: Capt. R. J. Baker (T.C.A.).

The Air Cadet League of Canada. Address: 122, Wellington Street, Ottawa, Ont. President and Executive Chairman: C. D. Taylor. Managing Director: G. M. Ross. Secretary and Treasurer: Mrs. R. S. Godfrey.

PUBLICATIONS

Canadian Aviation. Published monthly by the Maclean Hunter Publishing Co., Ltd., 481, University Avenue, Toronto, Ont. Subscription: \$2 British Empire; \$2.50 U.S.A.; \$3.00 Foreign Countries. Editor: Ronald A. Keith.

Canadian Air Cadet. Published by the Air Cadet League of Canada, 122, Wellington Street, Ottawa. Published monthly by the Air Cadet League of Canada. Subscription: \$1.00. Editor: Art MacDonald.

Aircraft and Airports. Published monthly from 341, Church Street, Toronto, Ont. Editor: Robert J. Burns.

Aviation Review. Published monthly by The Aeronautical Institute of Canada, 31, Willcocks Street, Toronto, Ont. Editor: N. W. Kingsland.

Aircraft and Jets. Published monthly from 222, Front Street East, Toronto. Editor: P. T. Sampson.

FLYING CLUBS

Flying Clubs are in operation at Halifax, N.S.; St. John, N.B.; Montreal, P.Q.; Ottawa, Ont.; Harrison, Ont.; Barrie, Ont.; Oshawa, Ont.; St. Catherines, Ont.; Kingston, Ont.; Toronto, Ont.; Hamilton, Ont.; Brantford, Ont.; Kitchener, Ont.; Windsor, Ont.; London, Ont.; Fort William, Ont.; Winnepeg, Man.; Brandon, Man.; Virden, Man.; Portage la Prairie, Man.; Regina, Sask.; Moose Jaw, Sask.; Saskatoon, Sask.; Melfort, Sask.; Calgary, Alta.; Edmonton, Alta.; Vancouver, B.C.; Victoria, B.C.; Prince George, B.C.; New Westminster, B.C.; Penticton, B.C.; Terrace, B.C.; Chilliwack, B.C.; Powell River, B.C.; Nanaimo, B.C.; Kamloops, B.C.; Comox, B.C.; Williams Lake, B.C.

BRITISH COMMONWEALTH—CANADA—*continued.*

TRANSPORT COMPANIES

Canadian Pacific Air Lines, Limited, 620, Dominion Square Building, Montreal, Quebec.
President: Grant W. McConachie.
Vice-President: W. M. Neal.

Maritime Central Airways, Limited, Charlottetown, Prince Edward Island.
President: J. K. Curran.
General Manager: C. F. Burke.

Trans-Canada Air Lines (T.C.A.). Head Office: P.O. Box 2873, McGill Street, Winnipeg, Manitoba.
President: H. J. Symington, C.M.G., K.C.
Equipment: 11 Lockheed 14, 14 Lockheed Lodestar, 24 Douglas DC-3 (6 Douglas DC-4M being delivered in 1947).

PROVINCIAL OR OTHER GOVERNMENTAL OPERATIONS

Ontario Provincial Air Service. Chief Base: Sault Ste. Marie.
The oldest provincial operator of aircraft. Maintains forest patrols, fire-fighting services, air transportation for provincial government officials.

Saskatchewan Government Air Service. Chief Base: Prince Albert, Sask.
Maintains forest patrols and fire-fighting services, also provides transportation for Government officials on business with mines, fishery, hunting, game-trapping, etc. Flying ambulance service in the North.

Royal Canadian Mounted Police, Aviation Division. H.Q.: Rockliffe, Ont.
Responsible for air transportation of personnel and supplies, search and rescue work, anti-smuggling patrols and mercy flights. Also employed on tours covering all R.C.M.P. gasoline and food caches in the North. Operates one Noorduyn Norseman, one Grumman Goose and two Beechcraft 18s aircraft. Seven pilots.

Central British Columbia Airways. Base: Prince George, B.C.
This commercial company holds a contract with the British Columbia Government for forest patrol and the transportation of personnel and supplies to the scenes of forest fires.

OTHER OPERATORS

There are many operators which are engaged in non-scheduled flying, charter work, flying instructions, air photographic, etc. Since the end of the war there has been a considerable increase in the number of such undertakings, and an up-to-date and reliable list of these concerns was not available at the time of going to press.

AIRPORTS

Prior to the war there were 103 licensed airports in the Dominion. During the war many of these closed down owing to the curtailment of commercial flying and the abandonment of private and club flying. By the beginning of 1946 licensed airports numbered 98 and by the end of 1946 this number had increased to 158. This number does not include emergency landing areas, flight strips and seaplane harbours. Altogether, there are nearly 600 locations which have runways of land or water and can handle air traffic.

COMMONWEALTH OF AUSTRALIA

ADMINISTRATION

Civil flying in the Commonwealth and Territories is subject to legislative control by the Commonwealth Government. The administration of the Air Navigation Act and Regulations is a function of the Department of Civil Aviation under the Minister for Civil Aviation, Mr. A. S. Drakeford. The permanent head of the Department is the Director-General of Civil Aviation, Air Marshal R. Williams, C.B., C.B.E., D.S.O. Assistant Director-General of Civil Aviation: Mr. E. C. Johnston.

ASSOCIATIONS

The Royal Aeronautical Society, with which is incorporated the Institution of Aeronautical Engineers, Australasian Branch: Science House, Gloucester and Essex Streets, Sydney.
Honorary Secretary: J. B. Mills, B.Sc., A.F.R.Ae.S.

The Associated Australian Aero Club. Address: Collins House, 360, Collins Street, Melbourne. Secretary: W. W. Vick.
The organization represents all the Australian Aero Clubs. It is affiliated to the Royal Aero Club of the United Kingdom and to the *Fédération Aéronautique Internationale* (F.A.I.).

The Institution of Engineers, Australia, Aeronautical Branch, Sydney Division. Address: Science House, Gloucester and Essex Streets, Sydney.
A branch of the professional engineers' society of Australia.

The Institution of Automotive Engineers (Aust.). Address: 55, Collins Street, Melbourne, C.1. President: L. J. Hartnett. Hon. General Secretary: Dr. H. Hirst.

The Guild of Aeronautical Engineers. Address: 75, Keaferd Street, Essendon North, Melbourne, W.6.

The Australian Air League. Incorporated Aug. 1, 1934. League Headquarters: Royal Exchange Building, 54a, Pitt Street, Sydney. General Secretary: K. C. Cameron. Branches: Victorian State Headquarters at Melbourne and Queensland State Headquarters at Brisbane.

The Australian Gliding Association. Address: 28, Princes Street, Footscray, Victoria. Secretary: R. Duckworth.

RESEARCH ORGANIZATIONS

Council for Scientific and Industrial Research. Aeronautical Research Laboratory, Fishermen's Bend, Melbourne, S.C.8, Victoria. Division of Forest Products: Yarra Bank Road, Melbourne, S.C.4., Victoria.

Australian Aeronautical Research Committee. Formed in 1941
Co-operation with the Aeronautical Research Committee in Great Britain is one of the defined functions of the new Committee.

FLYING CLUBS

The Royal Victorian Aero Club, Commonwealth Aerodrome, Essendon, Melbourne.

The Royal Aero Club of New South Wales, Kingsford Smith Aerodrome, Sydney.

The Royal Queensland Aero Club, Archerfield Aerodrome, Brisbane.

The Royal Aero Club of South Australia, 112, King William Street, Adelaide.

The Royal Aero Club of Western Australia, Inc., Maylands Aerodrome, Perth.

The Tasmanian Aero Club, Western Junction Aerodrome, Launceston.

The Newcastle Aero Club, P.O. Box 4, Broadmeadow.

The Spencer's Gulf Aero Club, Whyalla.

The Broken Hill Aero Club, Broken Hill.

PUBLICATIONS

Aircraft. Founded 1918. Published monthly, price 1/- (Overseas subscription: 16/- p.a.), by United Press Pty. Ltd. Editorial Offices: 62-74, Flinders Street, Melbourne, Victoria. London Office: 92, Fleet Street, E.C.4.

The Air Log. Published monthly, price 9d. (Overseas Subscription, British Possessions: 10/- p.a.), by the Proprietors, 75, Pitt Street, Sydney, N.S.W. Edited by Norman J. Tracy. Address: Box 2489 MM., G.P.O., Sydney, N.S.W.

TRANSPORT COMPANIES

The Australian Commonwealth Parliament passed the National Airlines Act in 1945 authorising the Commonwealth to operate exclusively interstate airways in Australia. Private air transport companies challenged the Act's constitutionality but the High Court of Australia upheld it, except those sections which gave the Commonwealth the sole right to operate interstate services. This means that the State is now competing with private enterprise in airline operation.

Aircrafts Pty. Ltd. Head Office: 63, Eagle Street, Brisbane, Queensland. Managing Director: R. S. Adair. Secretary: M. J. Nichol.

Airlines (W.A.) Ltd. Head Office: C.M.L. Buildings, St. George's Terrace, Perth, Western Australia. Managing Director: C. W. Snook. Chief Pilot and Traffic Manager: Capt. J. H. Moore.
Equipment includes Monospar S.T.11, D.H. 89 and D.H. 90 aircraft. One D.H. Dove is on order.

Ansett Airways, Ltd. Head Office: Commonwealth Airport, Essendon, Victoria. Managing Director: R. M. Ansett. Manager Airline Division: J. P. Ryland.
Equipment is believed to include Lockheed Electra aircraft.

Australian National Airways Pty. Ltd. Head Office: 390 Flinders Street, Melbourne, W.6. Managing Director: Captain Ivan N. Holyman. General Manager: Capt. L. J. Brain, A.F.C. Operations Superintendent: H. M. Smith.
This company increased its capital by £250,000 to £800,000 in the Summer of 1946.
Equipment includes Douglas DC-4, Douglas DC-3, Douglas DC-2, Lockheed 14, and D.H. 89 aircraft.

British Pacific Commonwealth Airlines, Ltd. Head Office: Sydney.
This company has been established to operate trans-Pacific and Pacific regional air services under the control of the Australian,New Zealand and United Kingdom Governments. Lord Knollys, chairman of B.O.A.C., is the U.K. Government representative.
Australia and Canada (through designated operators) will, as the result of an air agreement signed by the two countries, conduct trans-Pacific service jointly between Vancouver and Sydney. British Commonwealth Pacific Airlines will operate as the Australian airline company and Australian National Airways, as interim contractors for B.C.P.A., began the service on September 15, 1946. It is expected that the Canadian company will begin to operate in 1947 with pooling of rights and in parallel partnership with B.C.P.A.

BRITISH COMMONWEALTH—AUSTRALIA—*continued.*

Butler Air Transport Co. Head Office: Kingsford Smith Aerodrome, Sydney, New South Wales. Managing Director: C. A. Butler. Flight Superintendent: Capt. T. Young.
Equipment includes D.H. 84 and Douglas DC-3 aircraft.

Connellan Airways. Head Office: Alice Springs, Central Australia. Proprietor and Chief Pilot: E. J. Connellan.

Guinea Airways Ltd. Head Office: Austral Chambers, 16, Currie Street, Adelaide. Manager and Secretary: G. H. Archibald.
Routes:—
Equipment includes Douglas DC-3 and Lockheed Electra aircraft.

MacRobertson-Miller Aviation Co., Ltd. Head Office: 196, St. George's Terrace, Perth, Western Australia. Managing Director: H. C. Miller. Secretary: R. B. Patterson.
Equipment includes Douglas DC-3 and Lockheed Electra aircraft.

Qantas Empire Airways, Ltd. Head Office: Shell House, Carrington Street, Sydney, New South Wales. Managing Director: Hudson Fysh. General Manager: H. H. Harman. General Traffic Manager: C. W. Neilson.
Equipment includes Short "C" Class flying-boats and the following types of landplanes:—D.H. 83, Douglas DC-3 and Avro Lancastrian.

Trans-Australia Airlines.
This is the operating body for the Australian National Airlines Commission of the Commonwealth Government. It started its first service on September 9, 1946, between Melbourne and Sydney using Douglas DC-3 aircraft. Other services in direct competition with those of privately-owned established airlines were to be started by the end of 1946 on the following routes:—Melbourne — Sydney — Brisbane, Melbourne — Adelaide, Melbourne — Launceston, Melbourne —Hobart, Melbourne—Perth. A fleet of some twenty Douglas DC-3 and DC-4 aircraft is being delivered.

DOMINION OF NEW ZEALAND

ADMINISTRATION

On April 1, 1937, an Air Department was established in New Zealand to co-ordinate and administer all matters concerning Civil and Military Aviation under the responsibility of the Ministry of Defence in Wellington. Minister of Defence: Frederick Jones. Chief of Air Staff and First Air Force Member of Air Board: Air Vice-Marshall Sir Leonard M. Isitt, K.B.E. Air Secretary: T. A. Barrow. Controller of Civil Aviation: Wing-Cdr. J. M. Buckeridge.

Under the New Zealand National Airways Act, passed by Parliament on December 7, 1945, the New Zealand Government has formed a National Airways Corporation "for the purpose of establishing and operating national air transport services to meet the needs of the people of New Zealand, and for the purpose of fostering and encouraging the use of air transportation within New Zealand."

ASSOCIATIONS

The Royal New Zealand Aero Club, Inc. Address: 39, Johnson Street, Wellington. President: E. W. Pearce (Middle Districts Aero Club). Vice-Presidents: F. Cadman (Auckland Aero Club) and R. T. Cadwallader (Wellington Aero Club). Secretary: T. Hull.
The objects of the Club are to co-ordinate the effects of the provincial flying clubs officially recognised by the Government and to foster the development of commercial aviation. It is affiliated with the Royal Aero Club.

Royal Aeronautical Society, New Zealand Branch. Hon. Secretary: T. T. N. Coleridge, c/o. The Shell Co. of New Zealand, Ltd., P.O. Box 1663, Wellington.

The Guild of Aeronautical Engineers. Address: P.O. Box 11, Wellington. Registrar: G. H. Spence.

The Guild of Air Pilots. Address P.O. Box 11, Wellington. Master of the Guild: Wing-Cdr. G. Lomax Stedman. Registrar: G. H. Spence.

PUBLICATIONS

Whites Aviation. Published monthly price 1/- by Whites Aviation Ltd., 605, Dilworth Building, Auckland. Represented in United Kingdom by Norman Representation Service, 131, Fleet Street, London, E.C.4.

Wings. The official organ of the Royal New Zealand Aero Club, Inc. Published monthly. Price 6/- per annum. Address: 39, Johnston Street, Wellington.

TRANSPORT COMPANIES

Tasman Empire Airways, Ltd. Head Office: 36, Custom House Quay, Wellington. Chairman: Albert E. Rudder, C.B.E. (Sydney). Vice-Chairman: Charles G. White, O.B.E. (Wellington).

New Zealand National Airways Corporation.
Chairman: Air Vice-Marshal Sir Leonard Isitt (formerly Chief of Staff, R.N.Z.A.F.). Deputy Chairman: J. S. Hunter (Government Official). Other Directors: W. W. Hynes (Dominion President, Aircraft Workers' Union); F. W. Mothes (Managing Director of an advertising agency); H. Worrall (Managing Director, Air Travel (N.Z.), Ltd.).

This Government-owned monopoly corporation was formed under the New Zealand National Airways Act of December 7, 1945. The Board of Directors was finally chosen late in 1946 and by the end of 1946 preparations for taking over the independently-owned companies, operating internal services were being completed. A sum of £180,000 was voted by Parliament as the purchase price for Union Airways. Other companies to be absorbed are Air Travel (N.Z.), Ltd. and Cook Strait Airways, Ltd., and the Southern Pacific inter-island routes operated by the R.N.Z.A.F. will probably be taken over later. A number of Douglas C-47 transports have been acquired from U.S. disposals stock by the New Zealand Government for the use of New Zealand National Airways.

Union Airways of New Zealand, Ltd. Head Office: 36, Custom House Quay, Wellington. Directors: J. N. Greenland, C. G. White, Sir A. F. Roberts, K.B.E., Walter Green. General Manager: F. Maurice Clarke.

Air Travel (N.Z.), Ltd. Head Office: Southside Airport, Hokitika. Managing Director and Chairman: H. Worrall.

Cook Strait Airways, Ltd. Head Office: Corner Haven Road and Rutherford Street, Nelson. Managing Director: E. H. Thompson.
This company has been operated under charter by Air Travel and Union Airways.

Royal New Zealand Air Force.
The R.N.Z.A.F. continues to operate some of the air routes which it established during the war in the South Pacific, and will continue to do so until the newly-formed New Zealand National Airways Corpn. is able to take them over. Civil passengers and freight are carried.

FLYING CLUBS

At the end of 1946 the following Aero Clubs were in operation or preparing to operate as soon as aircraft and/or airfields became available:—Wellington, Auckland, Middle Districts (Palmerston North), Wairarapa and Ruahine, Hawke's Bay and East Coast, Marlborough, Otago, Southland (Invercargill), West Coast United (Greymouth), Waikato (Hamilton), Canterbury, Nelson, Wanganui and New Plymouth.

AIRPORTS

Until a decision has been reached concerning the internal routes to be operated by New Zealand National Airways Corpn., little progress is expected in the construction of civil aerodrome suitable for modern types of transport aircraft.

The Government has decided that the R.N.Z.A.F. airfield at Whenuapai, near Auckland, is to be used temporarily as the international civil landplane airport for New Zealand and temporary accommodation for handling civil airline passengers and for the technical and administrative staffs has been provided.

New airfields at Kaitaia, Kaikohe and Waharoa, built during the war, are being retained for future civil aviation purposes.

The only international marine terminal in New Zealand is at Mechanics Bay, Auckland. This is the terminal used by Tasman Empire Airways and Pan American Airways, as well as by the R.N.Z.A.F. Transport flying-boat squadrons.

THE UNION OF SOUTH AFRICA

(Die Unie van Suidafrika)

ADMINISTRATION

Civil Aviation in the South African Union is the responsibility of the Minister of Transport through the Secretary of Transport, within whose department is included the meteorological organization and the Civil Aviation Council, the latter being responsible for the carrying out of the Aviation Act. South African Airways, which is an integral part of the South African Railways and Harbours Organization, is also controlled by the Ministry of Transport.

Ministry of Transport, Union Buildings, Pretoria.
Minister of Transport: The Hon. F. C. Sturrock, M.P.

Railways and Harbours Board.
Railway Commissioners: W. R. F. Teichmann, F. T. Bates, J. D. P. Fourie.
General Manager, S.A. Airways: W. M. Clarke, O.B.E.
Chief Airways Manager: Major Gen. C. J. Venter, C.B., D.F.C.
Chief Superintendent (Airways): G. S. Leverton.

BRITISH COMMONWEALTH—SOUTH AFRICA—*continued.*

Civil Aviation Council.

Brig. Gen. C. G. Ross, C.B.E., D.F.C. (Chairman), Major D. Cloete, M.C., A.F.C. (other appointments pending).

Civil Aviation Advisory Committee.

The Civil Aviation Advisory Committee was constituted in 1946 to take the place of the former Civil Air Board. Its function is to advise the Minister of Transport on all civil aviation matters, particularly as regards regulations to be made under the Aviation Act and new air services recommended for establishment within the Union and between the Union and adjoining territories. The composition of the Committee is as follows:—

The Hon. F. C. Sturrock, M.P. (Minister of Transport), Chairman; The Secretary of Transport, Deputy Chairman: Maj. Gen C. J. Venter, C.B., D.F.C. (South African Railways and Harbours); E. B. Altona (under Secretary (Posts), Department of Posts and Telegraphs); W. H. Colere (S.A; Federated Chamber of Industries); G. S. Eden (Association of Municipal Airports and Aerodromes of South Africa); Major R. A. Powell, M.B.E., A.F.R.Ae.S. (South African Branch, Royal Aeronautical Society); A. E. P. Robinson (Commercial Aviation Association of South Africa); R. Makopeace, M.M. (Aero Club of South Africa); W. M. Winstanley (Association of Chambers of Commerce of South Africa).

ASSOCIATIONS

The Aero Club of South Africa. Address: Maritime House, Loveday Street, Johannesburg. Chairman: Roy Makepeace, M.M.

South African Branch, The Royal Aeronautical Society. Address: P.O. Box 5944, Johannesburg. Hon. Secretaries: Lieut.-Col. R. A. Powell, M.B.E., A.F.R.Ae.S. and Lieut.-Col. D. A. Mann.

Commercial Aviation Association of South Africa. Address: 305-306, Grand National Buildings, Rissik Street, Johannesburg President: W. M. Winstanley.

Association of Municipal Airports and Aerodromes of South Africa. Address: 305-306, Grand National Buildings, Rissik Street, Johannesburg. President: G. S. Eden.

PUBLICATIONS

Wings. The official magazine of the South African Air Force. Published by Wings, London House, 21, Loveday Street, Johannesburg. Price 6d. monthly. Editor: W. T. H. B. Lethbridge.

The Fly Paper. Published by Aviation Publications Ltd., P.O. Box 7105, Johannesburg.

TRANSPORT COMPANY

South African Airways (S.A.R. & H.).

Head Office: Germiston Airport, Johannesburg. General Manager: Major-Gen. C. J. Venter, C.B., D.F.C. Airways Superintendent: G. S. Leverton. Flying Superintendent: Col. Japie Louw.

South African Airways is part of the Administration of the South African Railways and Harbours.

INTERNATIONAL TRANSPORT COMPANIES

The following international air-carriers operate services to and through the Union:—

British Overseas Airways Corporation

S.A.B.E.N.A. (Belgian Congo).

Central African Airways Corporation (formerly Southern Rhodesian Air Services).

AIRPORTS

The Railway Administration is undertaking the construction of three large civil airports in the Union, to serve Johannesburg, Durban and Capetown.

The Union's permanent international airport will be established at Kempton Park, between Germiston and Pretoria and about 13 miles from the main railway station at Johannesburg. It will cover an area of more than 6,000 acres and provide three main runways, one 350 yards long, the others 2,750 yards.

Meanwhile a provisional airport for Johannesburg is in use at Palmietfontein, south of Johannesburg.

The Durban Airport will be built just north of Isipingo, while the Capetown Airport will be 5 miles W. of Bellville and 11¾ miles by road from the centre of the city.

The Railway estimates include a sum of £3,130,000 for expenditure on the three main civil airports for the Union, of which £500,000 is being spent in the current financial year.

EIRE

ADMINISTRATION

The Department of Industry and Commerce is responsible for the control of Civil Aviation in Ireland through the Aviation Branch of the Department, Kildare Street, Dublin.

Aeronautical, Meteorological, Radio and Air Traffic Control Services are maintained by the Department of Industry and Commerce.

ASSOCIATION AND FLYING CLUBS

Irish Aviation Club. Address: Abbey Buildings, Middle Abbey Street, Dublin. Chairman: Mr. Seán O h-Uadhaigh. Hon. Secretary: Mr. Chris F. Bruton. Hon. Treasurer: Mr. Denis M. Greene. Affiliated to the *Fédération Aéronautique Internationale* (F.A.I.).

This Club is responsible for the sport of flying in Eire. It represents five local flying clubs, three of which—at Dublin, Limerick and Galway—are either operating or awaiting delivery of aircraft for flying training. The total membership of the Clubs is about 500.

NATIONAL TRANSPORT COMPANIES

Aer Lingus Teoranta.

Head Office: 43, Upper O'Connell Street, Dublin. Chairman: John Leydon.

This company was formed in 1936, and was the first Irish air transport Company to operate regular services. Under a bi-lateral agreement between Ireland and the United Kingdom signed on April 5, 1946, the Capital of the company was increased to £1,000,000, 60% being held by Aer Rianta and 40% by the British European Airways Corpn. Three directors are being nominated by the British company and four by Aer Lingus. Under this agreement all services between Ireland and Great Britain will be operated by Aer Lingus.

Aer Rianta Teoranta.

Head Office: 43, Upper O'Connell Street, Dublin. Chairman: John Leydon. Directors: D. O h-Iarfhlaithe, J. P. Reihill, Sean O h-Uadhaigh, Seamus Fitzgerald.

This company holds 60% of the shares of Aer Lingus. It plans to operate a trans-Atlantic service with three Lockheed Constellations, which are due to be delivered in 1947.

INTERNATIONAL TRANSPORT COMPANIES

The following air transport companies are operating routes to and through Eire.

Air France (France).

American Overseas Airlines (U.S.A.).

British Overseas Airways Corporation (Great Britain).

Pan American Airways (U.S.A.).

Trans World Airline (U.S.A.).

AIRPORTS

DUBLIN (Collinstown). Lat. 53°25′N., Long. 06°15′W. Altitude above sea level 220 ft. 5 miles N. of Dublin. Civil Customs Airport. 4 grass runways ranging in length from 3,000 ft. to 5,288 ft. Work has started on three concrete runways, involving extension of grass runways length in some directions. Full facilities. The Airport is managed on behalf of the Department of Industry and Commerce by Aer Rianta Teoranta.

SHANNON (Rineanna). Lat. 52°42′N., Long. 08°55′W. Altitude above sea level 9ft. 15 miles W. of Limerick. Trans-atlantic airport with full facilities. Runways N.-S. 1,758 yds. × 50 yds., N.E.-S.W. 1,761 yds. × 67 yds., E.-W. 1,876 yds. × 50 yds., S.E.-N.W. 1,880 yds. × 50 yds. Extension of runways and development of airport planned. The flying-boat base at Foynes, 24 miles W. of Limerick, is not in use at present.

CHILE

(The Chilean Republic—Rèpublica de Chile)

ADMINISTRATION

The Department responsible for the administration of Civil and Commercial Aviation in Chile is the Aeronautics Department, which controls all civil flying. It is also responsible for the adoption of security measures for navigation (communications, signals, meteorological findings, etc.) and for the direction of commercial and tourist flying and the supervising of rules and standards governing Aerial Navigation. Airports and public and private aerodromes are likewise controlled by this Department.

TECHNICAL INSTITUTE

Instituto Aeronautico de Chile, Santiago.

Made up of professionals, technicians, airmen, experts, etc. The principal work of the Institute is as follows:—(1) To promote the study of aeronautics and similar sciences; (2) To stimulate and develop the scientific and technical aspects of aeronautics; (3) To publish information concerning aeronautics in general; and (4) Strengthen the links between the Institute of Chile and international aeronautics.

CHILE—*continued.*

ASSOCIATIONS

Club Aereo de Chile.
Headquarters: "Los Cerrillos" Airport. Administrative offices: Calle Lucia No. 256, 3rd Floor, Dept. B., Santiago. Affiliated to the *Fédération Aéronautique Internationale.* This is the principal Flying Club of the country and is responsible for the preparation of civil air pilots and for the running of all other similar entities. The Club receives a Government subsidy, which is distributed proportionately among the many Flying Clubs throughout Chile. The Club has the services of the "Aladino Azzari" School of Civil Aviation for the training of civil pilots.

PUBLICATIONS

Revista de la Fuerza Aerea. Published by the Ministro de Defensa Nacionale, Santiago. Published quarterly.
Chile Aéreo. The official publication of the Club Aerea de Chile. Avenida Bulnes 80, Santiago. Monthly.
Aeronautica. A monthly Review, the organ of the Instituto Aeronautico de Chile. Director: Lorenzo Redondoe.

AIR TRANSPORTS

Linea Aérea Nacional (L.A.N.).
Headquarters: "Los Cerrillos" Airport, Santiago.
President: Dr. Geronimo Mendez Arancibia. Executive Vice-President: Air Brigade General Rafael Saenz Salazar. Managing Director: Jorge Garreton.
The only national air transport organization in Chile.

INTERNATIONAL TRANSPORT COMPANIES

The following international air transport companies operate to and through Chile:—
Pan American Grace Airways ("Panagra").
British South American Airways Corporation.
Air France.
Servicos Aereos Cruziero do Sul.
Flota Aerea Mercante Argentina (F.A.M.A.)

AIRPORTS

SANTIAGO (Los Cerillos). Lat. 33°13′S. Long. 70°43′W. Alt. 525 m. Principal Customs Airport of Chile. Terminal of the Linea Aerea Nacional. Completely equipped. R/T. and night-flying facilities.
ARICA (El Moro). Lat. 18°28′S. Long. 70°20′W. Alt. 90 m. Principal Customs Airport in the north. Completely equipped. R/T. and night-flying facilities.

CHINA

(The Great Chinese Republic—Chung-Hua Min-Kuo)

ADMINISTRATION

Civil Aviation in China is under the control of the Ministry of Communications of the Central Government of China at Nanking. The Director of Civil Aviation is Colonel Tai An-Kuo.

ASSOCIATIONS

There is no news of any post-war activity by either the Aeronautical Federation of the Chinese Republic or the China Aviation League.

NATIONAL TRANSPORT COMPANIES

Central Air Transport Corporation. Head Office: Shanghai. General Manager: Colonel T. L. Chen. Vice-President: C. H. Cha.
This Chinese Government-owned concern was formerly Eurasia Airlines. It operates internal routes in China.
China National Aviation Corporation. Head Office: Shanghai. President: U. T. Hsu. Managing Director: Col. C. Y. Liu. Vice-President: W. L. Bond.
Pan-American World Airways (U.S.A.) reduced their holdings in this Chinese Government-owned concern from 45% to 20% in 1946.
Sino-Soviet Aviation Corporation (Hamiata). Head Office: Tihwa.
This concern is a joint Soviet Ministry of Communications enterprise which is believed to still operate a service between Hami and Alma Ata, linking the Chinese and Russian air line networks.

CUSTOMS AIRPORTS

KUNMING (Wuchiapa). Lat. 25°00′N., Long. 102°45′W. Altitude 6,240 ft. 2,406 yds. × 164 yds.
CANTON (Peiyun). Lat. 23°10′N., Long. 113°18′E. Altitude 25 ft. Two runways 1,859 yds. × 142 yds. and 1,312 yds. × 109 yds.
SHANGHAI (Lunghwa). Lat. 31°10′N., Long. 121°27′E. Altitude 20 ft. Four runways N.E.-S.W. 2,187 yds. × 131 yds., E.-W. 1,202 yds. × 131 yds., N.-S. 1,968 yds. × 131 yds., N.W.-S.E. 1,312 yds. × 131 yds.
Note:—The military airfield at Kiangwan, near Shanghai, has been opened for commercial use while the runways at the Lungwa Airport are being extended.
TIENTSIN (Changkneichuang). Lat. 39°07′N., Long. 117°21′E. Altitude 10 ft. One runway N.N.W.-S.S.E. 1,094 yds. × 87 yds.

COLOMBIA

(The Republic of Colombia—República de Colombia)

ADMINISTRATION

The general administration of Civil Aviation is controlled by the Ministry of War through the Dirección General de Aeronáutica Civil, which interprets the regulations officially laid down. Director of Civil Aviation: Lieut.-Col. Gustavo Rojas Pinilla. Address: Ministerio de Guerra, Bogotá.

PUBLICATION

Boletin da Aeronautica Civil (Bulletin of Civil Aeronautics). Edited by the General Administration of Civil Aviation. Address: Seventh Street 7-50 (third floor), Bogotá. Distributed free of charge every two months.

NATIONAL TRANSPORT COMPANIES

Aerovias Nacionales de Colombia (Avianca).
Head Office: Avianca Building, Barranquilla.
President and General Manager: Dr. Martin del Corral. Operations Director: Thomas N. White. Operations Superintendent: Ernest J. Smith.
This company, an affiliate of Pan American Airways, is controlled by Colombian nationals. A merger with the Venezuelan company Linea Aeropostal Venezolana and the Ecuadorian Government Air Line is planned. This new company will be known as the Great Colombia Airline.
Compagnia de Navegacion Aerea Lansa Ltda. Head Office: Bogotá.
Limitada Nacional de Servicio Aereo. Head Office: Barranquilla.
Lineas Aereas T.A.C.A. de Colombia, S.A. Head Office: Edificio Clavijo, Bogota. Manager: Alirio Gomez-Picon. Operations Manager: Wilbur Bradley.
This company's shares are owned partly by Colombian nationals (55%) and partly by the T.A.C.A. Company (45%).
Vias Aereas Colombianas S.A. Head Office: Cali.
Uraba, Medellin and Central Airways, Inc. Head Office: Carabobo 320, Medellin. President: H. Max Healey.
This company is affiliated to Pan American Airways.

INTERNATIONAL TRANSPORT COMPANIES

The following Companies operate air services to and through Colombia:—
K.L.M. Royal Dutch Air Lines. (Netherlands West Indies).
Pan American Airways. (U.S.A.).
Pan American-Grace Airways. (U.S.A.).
Linea Aerea T.A.C.A. de Venezuela. (Venezuela).

AERODROMES

AGUAS CLARAS, ARAUCA, BOGOTÁ, BUCARAMANGA, CALI, CARTAGO, COROZAL, CUCUTA, CABUYARO, CRAVO NORTE, EL MORRO, HATO DE COROZAL, HONDA, IPIALES, MEDELLIN, MORENO NEIVA, NUNCHIA, OROCHE, OTU, POPAYAN, PUERTO CARRENO, SAN MARTIN, SAN MATEO, SAN JOSÉ, LA TRINIDAD, TAME, VALLEDUPAR, VILLAVICENCIO.

SEAPLANE STATIONS

BUENAVENTURA, CHOQUICHOQUI, EL BANCO, GAMARRA, GIRARDOT, GUAPI, LA GLORIA, LORICA, MAGANGUE, PUERTO WILCHES, PUERTO BERRIO, QUIBDO, RIO SUCIO, SANTA MARGARITA, TUMACO.

COMBINED AERODROMES AND SEAPLANE STATIONS

AYAPEL, BARRANQUILLA, BARRANCA BERMEJA, CARTAGENA, CIENAGA, PALANQUERO, PATO, SAN MARCOS, TURBO, MONTERIA.

COSTA RICA

(The Republic of Costa Rica—República de Costa Rica)

ADMINISTRATION

Civil Aviation is controlled by the Department of Civil Aviation (Departmento de Aviacion Civil), a department of the Ministry of the Interior. The Director of Civil Aviation is Ricardo Jinesta.

ASSOCIATION

The Costa Rican Wing of the Inter-American Escadrille.
Formed in 1941. President: Alfredo Volio Mata.

NATIONAL TRANSPORT COMPANIES

Compania de Transportes Aéreos Centro-Americanos de Costa

COSTA RICA—*continued.*

Rica. (T.A.C.A. de Costa Rica). Head Office: San José. President: Charles L. Gallo. Manager: Roman Macaya. Secretary: Sherman Wilson.

This company is owned jointly by the T.A.C.A. company and by Costa Rican citizens.

Transportes Aereos Nacionales (T.A.N.). Head Office: San José.

This company was formed in 1946 to operate services from San José with two Avro Ansons bought from the Canadian War Assets Corporation.

INTERNATIONAL TRANSPORT COMPANIES.

The following air transport companies operate to and through Costa Rica:—

Lineas Aereas T.A.C.A. de Colombia. (Colombia).
Pan American Airways. (U.S.A.).
T.A.C.A. (El Salvador).

CUSTOMS AIRPORTS

San Jose (Savana). Lat. 09°56'N., Long. 84°06'W. Altitude 3,716 ft.

Puerto Jimenez. Lat. 8°34'N., Long. 83°21'W. Alt. 1½ m. Field 700 × 100 m. with landing strip 700 × 30 m., N./S. W/T. call sign T1J.

Puntarenas. Lat. 9°58'N., Long. 84°49'W. 6 kilos E. of town. Alt. 2 m. Runway 1,000 × 100 m. W/T. call sign T1P.

La Sabana (San Jose). Customs Airport. Lat. 9°56'N., Long. 84°04'W. 1 mile W. of San José. Altitude 1,180 m. Runway 1,000 × 200 m. Hangers. Radio and weather reports available.

Santana. Lat. 9°53'N., Long. 84°15'W. 12 miles W. of San José. Owned by P.A.A. Alt. 850 m. Runway 870 × 60 m. W/T.

Urena de Perez Zeledon. 4 kilos from Urena. Alt. 800 m. Runway 800 × 150 m. W/T. call sign T1G.

Villa Quesada. 1½ miles North of Villa Quesada. Alt. 620 m. Runway 500 × 50 m.

There are private landing grounds at the following places:—

El Jobo Hacienda, Guanacaste. Owned by Francisco Hurtado. Alt. 140 m. Runway 700 × 75 m.

El Tempisque, Guanacaste. Owned by Federico Sobrado. Alt. 90 m. Runway 1,200 × 200 m.

Puerto Cortes, Puntarenas. Owned by Francisco Olasa Reig. Alt. 15 m. Runway 675 × 85 m.

Taboga, Hacienda, Guanacaste. Owned by Julio Sachez L. Near town of Canas. Runway 610 × 40 m.

There is an auxiliary field, Barra del Colorado, at Limon. Lat. 10°47'N., Long. 83°35' W. ½ mile E. of village of La Barra. Runway N.N.W./S.S.E. 900 × 50 yds. W/T. to S.W.

CUBA

(The Republic of Cuba—República de Cuba)

ADMINISTRATION

The Ministry of Communications and Justice controls Civil Aviation. Permits to fly over the island are granted by the Secretary of State and the Ministry of Defence.

NATIONAL TRANSPORT COMPANIES

Compania Cubana de Aviacion, S.A. (Cubana). Head Office: Prado 252, Havana. President: Manuel Quevedo, Jr.

This company was originally a subsidiary of Pan American Airways. In 1946, Pan American ceded its 52% holding to Expreso Aereo Inter-Americano, which is now endeavouring to obtain the remaining 48% from scattered minority holdings.

Aerolineas Cubanas (Cuban Air Lines). Head Office: Manzana de Gomez 342, Havana. President and General Manager: Major Luis F. Ardois.

Expreso Aereo Inter-Americano. Head Office: Prado 204, Havana. President: Dr. Teodoro Johnson.

This company began operations in 1943. It is the official Cuban airmail carrier. In July, 1946, it obtained control of the Cia. Cubana de Aviacion S.A. (which see).

INTERNATIONAL TRANSPORT COMPANIES

The following companies operate air serivces to and through Cuba:—

Compania Mexicana de Aviacion. (Mexico).
K.L.M. Royal Dutch Airlines. (Netherlands West Indies).
Pan American Airways. (U.S.A.).
T.A.C.A. (Salvador).

CUSTOMS AIRPORT

Rancho Boyeros (Havana). Lat. 23°00'N. Long. 82°25'W. 10 miles S. of Havana. Alt. 300 ft. 4,000 ft. paved runway. Administrative building and hangar. Obstruction lights. Beacon on top of administration building. Service and full repairs available. This is the official airport of entry.

CZECHOSLOVAKIA

(The Czechoslovak Republic—Ceskoslovenske Republika)

ADMINISTRATION

Civil Aviation is under the jurisdiction of the Ministry of Communications. The Director of Civil Aviation is Ing. Bervida.

ASSOCIATION

Aeroklub Republiky Ceskoslovenske (Aero Club of the Czechoslovak Republic). Address: Swecky 22, Praque.
Affiliated to the *Fédération Aéronautique Internationale* (F.A.I.)

NATIONAL TRANSPORT COMPANY

Ceskoslovenske Aerolinie (C.S.A.). Head Office: 24, Vodickova, Prague. Director General: Ing. Ferdinand Trebichavsky. Deputy Director General: Dr. Karel Fink. Manager: Frantisek Dvorsky.

C.S.A. is a state-owned concern with staff drawn from the pre-war C.S.A. and C.L.S. airlines. Although their flying equipment was seized by the Germans and their routes taken over by D.L.H., many of their staff were allowed to stay on at Ruzyn airport. They saved the airfield from being blown up by removing and neutralising the mines set by the Germans to explode a short while after their retreat. By using German equipment air services in Czechoslovakia were started very shortly after the country's liberation. Initially Siebel Si 204's, Junkers Ju 52's and Ju 290's were used, piloted by R.A.F.-trained Czech Air Force pilots.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Czechoslovakia:—

Air France (France).
A.B.A. (Sweden).
British European Airways Corporation (Great Britain).
K.L.M. (Netherlands).
L.O.T. (Poland).
Putnik (Yugoslavia).
Pan American Airways (U.S.A.).
S.A.B.E.N.A. (Belgium).
Soviet Air Lines (U.S.S.R.).
Swissair (Switzerland).

CUSTOMS AIRPORT

Prague (Ruzyn). Lat. 50°06'N., Long. 14°17'E. Altitude 363 m. Four main runways 5,900 ft. × 131 ft. (1,800 m. × 60 m.), 3,280 ft. × 131 ft. (1,000 m. × 40 m.), 4,265 ft. × 131 ft. (1,300 m. × 60 m.), 2,950 ft. × 131 ft. (1,000 m. × 40 m.). Plans for expansion include lengthening existing runways and adding further new ones.

DENMARK

(The Kingdom of Denmark—Kongeriget Danmark)

ADMINISTRATION

Civil Aviation is under the jurisdiction of the:—

Ministeriet for offentlige Arbejder (Ministry of Public Works).
Address: Slotsholmsgade 10, Copenhagen K.
Minister: N. Elgaard.
Chief of Departement: Palle Christensen.

The direct control of Civil Aviation and the Administration of the state-owned civil airports is exercised by the:—

Direktoratet for Luftfartsvæsebet (Director of Civil Aviation).
Address: Torvegade 45, Copenhagen K.
Director: Knud Gregersen.

Statens Luftfartstilsyn (Air Inspection Department).
Address: Ny Kongensgade 15, Copenhagen K.
Chief: M. P. Eskildsen.

ASSOCIATIONS

Det Kongelige Danske Aeronautiske Selskab (Royal Danish Aeronautical Society).
Address: Norre Farimagsgade 3, Copenhagen.

This society is affiliated to the *Fédération Aéronautique Internationale.* There are about 150 associated flying, gliding and soaring and model flying clubs throughout Denmark.

PUBLICATIONS

Efterretninger for Luftfarende (Notice to Airmen). Produced by the Department of Civil Aviation.

Flyv (Fly). Official Publication of the Royal Danish Aeronautical Society.

DENMARK—*continued.*

AIR TRANSPORT COMPANIES

Det Danske Luftfartselskab A/S (Danish Air Lines—DDL).
Head Office: Raadahuspladsen 59, Copenhagen.
Operational Headquarters: Kobenhavns Lufthavn, Kastrup.
President and General Manager: K. Lybye. Board of Directors: P. Kampman, H. P. Christensen, H. Bech-Brunn, A. P. Botved, A. Krog, I. A. Korbing, C. B. Bollerup Madsen, R. Schmidt, Otto Wolf, S. Nielsen.

About 18% of the capital of Danish Air Lines is owned by the State and it has an honorary board composed of prominent Danes, with H.R.H. Prince Axel as President, in addition to the Board listed above.

The company is participating in the Scandinavian Airlines trans-Atlantic service, to which it is contributing two Douglas DC-4 airliners.

INTERNATIONAL TRANSPORT COMPANIES

(Operating to and through Denmark).

A.B. Aerotransport (Sweden).
Air-France (France).
American Overseas Airlines (U.S.A.).
British European Airways Corpn. (England).
Det Norske Luftfartselskap A.S. (Norway).
K.L.M. (Netherlands).
S.A.B.E.N.A. (Belgium).
Ceskoslovenske Aerolinie (Czechoslovakia).
Flugfelag Islands (Iceland).

CUSTOMS AERODROMES

COPENHAGEN (Kastrup). Lat. 55°37'N., Long. 12°39'E. 10 kms. S.E. of the city. Property of the Government. Four concrete runways N.E.-S.W. 1,800 m. (to be extended to 2,300 m.). N.W.-S.E. 1,600 m., E.-W. and N.-S. 1,200 m. long. W/T. direction-finding and teletype installation. The administration building, opened in 1939, will be replaced by a bigger building on the extended airport.

AALBORG WEST (Rodslet). Lat. 57°05'N., Long. 09°51'E. This aerodrome is property of the Government.

In the near future State-owned aerodromes will be opened at AARHUS, ODENSE and RONNE (Bornholm), the last named place by modernizing and extending a private airport.

DOMINICAN REPUBLIC

(Santo Domingo—República Dominicana)

ADMINISTRATION

Civil aviation is under the control of the Department of War and Navy. Address: Ciudad Trujillo, Dominican Republic.

NATIONAL TRANSPORT COMPANY

Compania Dominicana de Aviación, C por A. Head Office: Ciudad Trujillo. President: C. A. McLaughlin.

This company was organized in 1944 to carry passengers, mails, and cargo in the Dominican Republic.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through the Dominican Republic:—

British West Indian Airways (British West Indies).
Empreza de Transportes Aerovias Brasil (Brazil).
K.L.M. Royal Dutch Airlines (Netherlands West Indies).
Pan American Airways (U.S.A.).
TACA (Honduras).

CUSTOMS AIRPORT

GENERAL ANDREWS AIRPORT, Ciudad Trujillo. Paved runways. There are complete facilities at this airport, for servicing all types of aircraft, both commercial and military.

Action has been initiated by the Government to improve existing airports and to construct additional aerodromes.

ECUADOR

(The Republic of Èl Ecuador—República del Ecuador)

ADMINISTRATION

Civil Aviation in Ecuador is controlled by the Ministry of National Defence and is under the direction of Major Jorge Paez Mena.

NATIONAL TRANSPORT COMPANY

Aerovias del Ecuador-Panagra.
Agents: Grace y Cia (Ecuador), Malecon y General Elizalde 1302, Guayaquil.

This is the local Ecuadorian name for the services of Pan American-Grace Airways (U.S.A.) which have been operated since March, 1942, following the elimination of the German sponsored S.E.D.T.A. company.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Ecuador:—

Pan American-Grace Airways (U.S.A.).
Taca de Colombia (Colombia).
Vias Aereas Colombianas, S.A. (Colombia).

AERODROMES

GUAYAQUIL (Simon Bolivar). Lat. 2°10'S., Long. 79°52'W., Alt. 10 ft. 1 mile N. of city. 1,600 × 1,100 yds. Runways N.N.E./S.S.W. 1,094 yds., N.W./S.E. 547 yds. Hangars, beacon and boundary lights. W/T. call sign HCU. Wave length 3,076 m.

This is a military combined airport and seaplane base but civilian aircraft may land with permission.

QUITO (Mariscal Sucre). 4½ m. N. of town. Alt. 9,400 ft. 2,640 × 492 ft.

In addition to the above two main airports others are situated at ESMARALDAS, MANTA, SALINAS, CUENCA-LOJA, LATACUNGA, RIOBAMBA and COTOPAXI.

EGYPT

(The Kingdom of Egypt—Misr)

ADMINISTRATION

The Department of Civil Aviation in Egypt comes under H.E. Sayed Selim, the Minister of National Defence.

The Director-General of Civil Aviation is Mohamed Roushdy Bey and the Deputy Director is Mustapha Riad Moursi, B.Sc., D.I.C.

ASSOCIATION

The Aéro Club d'Egypte. Affiliated with the *Fédération Aéronautique Internationale.*

NATIONAL TRANSPORT COMPANIES

Misr Airlines S.A.E. Head Office: Almaza Airport, Heliopolis. President: Dr. HafezAfifi Pasha. Managing Director: H. E. Hassan Sadok Pasha. Government delegate member of the Board and General Manager: H. E. Mohamed Rouchdy Bey.

This first Egyptian Aviation Company, which was formed in association with the British aviation company Airwork, Ltd., holds an authorisation from the Egyptian Government for the establishment and operation, within Egyptian territorial limits, of civil flying training schools, local passenger-carrying flights, service stations for the provisioning, maintenance, and repair of civil aircraft, regular and occasional civil air transport services for the carriage of passengers, mails and goods within Egypt and between Egypt and abroad.

Egyptian Airways.
Head Office: Cairo.

An independent company which is being formed by Egyptian interests and the British Overseas Airways, Corpn. It will have an initial capital of £250,000, of which 51% will be held by Egyptian interests. There will be four Egyptian and three British directors.

The company, which will fly under the Egyptian flag, plans to operate external routes from Egypt which do not parallel those of Misr Airlines, including one to Great Britain. B.O.A.C. will provide personnel and technical assistance.

INTERNATIONAL TRANSPORT COMPANIES

The following air transport companies are operating routes to and through Egypt:—

A.B. Aerotransport (Sweden).
Air France (France).
B.O.A.C. (Great Britain).
Ethiopian Airlines (Abyssinia).
K.L.M. (Netherlands).
Middle East Airlines (Lebanon).
Trans World Airline (U.S.A.).

FLYING SCHOOL

The Misr-Airwork Flying School
Almaza Airport, Cairo.

In addition to flying training for both A and B licences the school includes Ground Engineering and Radio instructional establishments. There are also branch flying schools at Alexandria and Port Said.

AERODROMES

CAIRO (Almaza). Lat. 30°04′N., Long 31°21′E. 5 kms. E. of city. Alt. 262 ft. Full facilities.

FAROUK (Payne Field). Lat. 30°08′N., Long. 31°24′E. 14 km. N.E. of Cairo. Altitude 235 ft. Full facilities. Built by the U.S. Government and transferred to the Egyptian Government on December 16, 1946.

MERSA MATRUH. Lat. 31°21′N., Long. 27°14′E. 4 kms. S.W. of Mersa Matruh town. Altitude 45 ft.

ALEXANDRIA (Dekheila). Lat. 31°08′N., Long. 29°48′E. 8 kms. S.W. of city. Alt. 7 ft. Full facilities.

ASWAN. Lat. 24°03′N., Long. 32°54′E. 2 kms. S.E. of town. Alt. 400 ft. Area 850 × 680 yds. No facilities.

ASSIUT. Lat. 27°13′N., Long. 31°06′E. 8 kms. W. of town. Alt. 150 ft. No facilities.

MINIA. Lat. 28°05′N., Long. 30°44′E. 2 kms. W. of town. Alt. 130 ft. Administration buildings, etc.

LUXOR. Lat. 25°41′N., Long. 32°42′E. 5 kms. E.S.E. of town. Alt. 250 ft.

SOLLUM. Lat. 31°34′N., Long. 25°08′E. 2 kms. W. of town. Alt. 590 ft.

PORT SAID. Lat. 31°17′N., Long. 32°15′E. 4 kms. W. of city. Alt. sea level. Full facilities.

ETHIOPIA

(The Kingdom of Abyssinia—Nangesti Aithopia)

The U.S. airline Transcontinental & Western Air, Inc., has concluded a contract with the Ethiopian Government for the management of all Ethiopian civil air transport. In addition to providing internal air services, T.W.A. will be responsible for certain supervisory functions for and on behalf of the local government.

Ethiopian Airlines, in which T.W.A. has 25% financial interest, will be staffed by U.S. citizens and will use American aircraft. Initially, six converted Douglas C-47's have been delivered to Addis Ababa and these will be used on the main routes which are intended to serve as feeders for T.W.A. trunk routes from the United States to the Near, Middle and Far East. The first service opened was one from Addis Ababa to Cairo.

FINLAND

(The Finnish Republic—Suomen Tasavalta)

ADMINISTRATION

Civil Aviation in Finland is controlled by the Ministry of Communications and Public Works, in which ministry there is a Department of Civil Aviation. The address of the Department is Aleksanterinkatu 3, Helsinki.

ASSOCIATIONS

Suomen Ilmailulitto Flygforbund R. (Finnish Aeronautical Association).
Address: Mannerheimintie 16A, Helsinki.
President: Colonel (Ret.) P. G. Waris.
Affiliated to the *Fédération Aeronautique Internationale* (F.A.I.).

Ilmailunsinoorien Kerho (Club of Aeronautical Engineers).
Address: Aleksanterinkatu 46A, Helsinki.

TRANSPORT COMPANY

Aero O/Y.
Head Office: Mannerheimintie 9, Helsinki.
Aero O/Y resumed flying on its internal services to Western and Northern Finland on August 13, 1946. Proposals to nationalise the company have been discussed but have not developed far.

CUSTOMS AIRPORTS

HELSINKI (Tattarmossen). Lat. 60°N., Long. 25°03′E. Altitude 15 m. Runways N.-S. 1,540 yds. × 77 yds., N.E.-S.W. 1,320 yds. × 77 yds., E.-W. 880 yds. × 77 yds., N.W.-S.E. 800 yds. × 77 yds.

TURKO (Abo). Lat. 60°28′N., Long. 22°12′E. Altitude 6.2 m. Runways N.-S. 875 yds. × 30 yds., E.-W. 975 yds. × 30 yds., N.E.-S.W. 875 yds. × 30 yds., N.W.-S.E. 830 yds. × 30 yds.

FRANCE

The French Republic—(République Française)

ADMINISTRATION

On January 1, 1946, a **Secrétariat-Général de l'Aviation Civile et Commercial** (Department of Civil Aviation) was formed and attached to the **Ministère des Travaux Publiques et des Transports** (Ministry of Public Works and Communications). This Department consists of the following divisions:—

(*a*) **Direction des Bases Aériennes**—responsible for the construction and maintenance of all aerodromes.
(*b*) **Direction de la Navigation Aérienne**—responsible for safety on air routes, communications and navigational aids.
(*c*) **Direction de Transports Aériens**—to control and co-ordinate air transport.
(*d*) **Service de la Météorologie Nationale.**

ASSOCIATIONS

Aéro-Club de France. 6, Rue Galilée, Paris. The representative body governing the sport of flying in France. Affiliated to the *Fédération Aéronautique Internationale.* President: Baron de la Grange.

Association des Aéro-Clubs Scolaires et Post-Scolaires de France. 36, Avenue de Wagram, Paris.

Association des Anciens Elèves de l'Ecole Supérieure Nationale de l'Aéronautique. 32, Boulevard Victor, Paris.

Association des Professionnels Navigants d'Aviation. 6, Rue Galilée, Paris.

Association Française Aérienne. 77, Boulevard Malsherbes, Paris.

Club Aéronautique Universitaire. 6, Rue Galilée, Paris.

PUBLICATIONS

Aéro-Revue Française. Published weekly from 72, Avenue des Champs-Elysées, Paris (8e). Editor: René Brilliet.

Aviation Française. Published monthly from 43, Rue de Dunquerque, Paris (10e).

Envols. Published monthly by La Parisienne d'Editions et de Publicité, 13-15, Rue Taibout, Paris (9e).

Espaces. Published monthly from 43, Rue de Dunquerque, Paris (10e). Editor: E. Leygue.

L'Aérophile. Published monthly from 6, Rue Galilée, Paris. Editor: Edmond Blondel la Rougery.

L'Air. Published twice monthly from 71, Avenue des Champs-Elysées, Paris (8e). Editor: Georges Fraichard.

L'Air pour les Jeunes. Published from 71, Avenue des Champs-Elysées Paris (8e).

Les Ailes. Published weekly from 77, Boulevard Malsherbes, Paris (8e). Editor: Georges Houard.

Mondaéro. Published twice monthly by La Parisienne d'Editions et de Publicité, 13-15, Rue Taibout, Paris (9e).

AIR TRANSPORT

The operation of all French external air services of national interest is entrusted to Air France, a company which enjoys considerable commercial freedom. Air France is assured of a guaranteed milage by the Secretariat of Civil Aviation. In effect, Air France operates as a subsidised company, for which a maximum credit of 1,000,000,000 francs was approved for 1946.

NATIONAL TRANSPORT COMPANY

Air France.
Head Office: 2, Rue Marbeuf, Paris. General Manager: Henri Desbruères. General Traffic Manager: René Briend. Operations Manager: Capitaine de Vaisseau Paul Hebrand. Technical Manager: André Seguin. Secretary-General: Maurice Lemoine.

On January 1, 1946, Air France, by taking over control of all air services which had previously been operated by the military authorities, resumed its place as the French national air transport company, with a capital of 120,000,000 francs.

By the Autumn of 1946, the company possessed 154 aircraft. To man these a large crew-training programme was put into operation and 200 pilots, 100 radio officers and 120 flight engineers were due to be trained during 1946. The flying school is at Le Bourget while the flight engineers are trained at Blagnac, near Toulouse.

Le Bourget is used by services to European destinations and Orly for all overseas services.

Equipment (at end of 1946):—Forty S.O.161 Languedoc, thirty-two Douglas DC-3, fifteen Douglas DC-4, thirteen Lockheed Constellation, ten Lockheed 14 or Lodestar, fifty-three A.A.C.I. (French-built Junkers Ju 52), six NC 701 (French-built Siebel Si 204), six Dewoitine 338, five Bloch 221, two LeO 246 and twenty-five S.O. 94.

OTHER OPERATING COMPANIES

The Secretariat of Civil Aviation may authorise independent companies to engage in (*a*) regular air services over routes not served by Air France; (*b*) unscheduled freight and cargo transport; (*c*) air taxi-service; (*d*) seasonal air traffic.

FRANCE—*continued.*

At the end of 1946, there were in all about 50 registered companies with authorization to engage in non-scheduled flying in the various categories mentioned above, but neither a complete list of these companies nor details of their operations were available at the time of going to press. For various reasons, it is unlikely that all had begun operating by the end of the year.

AERODROMES

At the Liberation, all aerodromes (about 800), were unserviceable because of ditches, bomb craters, mines or other obstructions. In most cases airport installations and buildings were also damaged or destroyed. By the end of 1946, however, 66 public aerodromes had been made serviceable in France, of which six have runways of 2,000 m. minimum in length, thirty-four have runways of 1,500 m. in minimum length and fourteen have runways between 1,000 and 1,500 m. in length.

In the French Colonies 80 public aerodromes are serviceable.

CUSTOMS AIRPORTS IN THE FRENCH UNION

Metropolitan France

AJACCIO (Campo del Oro). Island of Corsica. Lat. 41°55′N. Long. 08°48′E. Altitude 50 ft. Runways 024°-204° 1,900 ft. × 150 ft. Ajaccio seaplane customs harbour at Lat. 41°55′N., Long. 08°44′E.

BASLE-MULHOUSE (Blotzheim). Franco-Swiss airport with French customs service on airport and Swiss customs at Franco-Swiss border. Altitude 876 ft. Lat. 47°36′N., Long. 07°31′E. Runway 160°-340° 1,310 yds. × 44 yds.

BISCARROSSE. Seaplane Customs harbour. Lat. 44°22′N., Long. 01°22′W.

BORDEAUX (Mérignac). Lat. 44°50′N., Long. 00°42′W. Altitude 154 ft. Runways 055°-235° 2,295 yds. × 85 yds., 115°-295° 1,800 yds. × 85 yds.

CANNES (Mandelieu). Lat. 43°33′N., Long. 06°57′E. Altitude 7 ft. No runways.

CHERBOURG (Querqueville). Lat. 49°40′N., Long. 01°41′W. Altitude 15 ft. Runways E. by S.W. by N. 1,300 yds. × 40 yds.

LILLE (Lesquin). Lat. 50°34′N., Long. 03°06′E. Altitude 147 ft. Runways N.N.E.-S.S.W. 1,740 yds. × 55 yds. E.N.E.-W.S.W. 1,740 yds. × 55 yds.

LYON (Bron). Lat. 45°44′N., Long. 04°56′E. Altitude 643 ft. Runway S.S.E.-N.N.W. 2,000 yds. × 65 yds.

MARSEILLE (Marignane). Lat. 43°26′N., Long. 05°13′E. Altitude 24 ft. Runway 142°-322° 2,330 yds. × 66 yds. Also seaplane facilities.

NICE (Californie). Lat. 43°40′N., Long. 07°13′E. Altitude 8 ft. Runway 040°-220° 1,475 yds. × 45 yds.

PARIS (Le Bourget-Dugny). Lat. 48°57′N., Long. 02°26′E. Altitude 144 ft. Runway 087°-267° 1,750 yds. × 65 yds. As from November 1, 1946, this airport only open to public transport aircraft equipped with radio to enable them to communicate with the airport local control.

PARIS (Orly). Lat. 48°33′N., Long. 02°23′E. Altitude 300 ft. Runways 030°-210° 1,975 yds. × 65 yds.; 080°-260° 1,650 yds. × 65 yds. This airport is only open to aircraft specially authorised to land there.

PARIS (Cormeilles-en-Vexin). Alternative airfield to Le Bourget and Orly. To be used permanently as an "escale technique" for freight-carrying aircraft. Customs.

PARIS (Toussus-le-Noble). For use by private aircraft and aircraft belonging to air-taxi undertakings irrespective of whether they are equipped with radio or not. Customs.

STRASBOURG (Enzheim). Lat. 48°33′N., Long. 07°38′E. Altitude 500 ft. Runway 069°-249° 1,550 yds. × 40 yds.

TOULOUSE (Blagnac). Lat. 43°37′N., Long. 01°22′E. Altitude 482 ft. Runways 153°-333° 1,965 yds. × 65 yds., 116°-875° 875 yds. × 44 yds.

DEAUVILLE (St. Gatien). Lat. 49°N., Long. 00°10′E. Altitude 460 ft. No runways. Light aircraft only (up to 5,000 lbs.).

DINARD (Pleurtuit). Lat. 48°36′N., Long. 02°05′W. Altitude 197 ft. Runways N.-S. 1,900 yds. × 65 yds., S.E.-N.W. 1,750 yds. × 65 yds.

LE TOUQUET. Lat. 50°31′N., Long. 01°38′E. Altitude 16 ft. Runway 620 yds. long. Light aircraft only.

Algeria

ALGIERS (Maison Blanche). Lat. 36°42′N., Long. 03°14′E. Altitude 72 ft. Runways E.-W. 2,000 yds. × 46 yds., N.E.-S.W. 1,533 yds. × 43 yds.

BONE (Les Salines). Lat. 36°50′N., Long. 07°48′E. Altitude 15 ft. Runways N.N.E.-S.S.W. 1,965 yds. × 50 yds., E.S.E.-W.N.W. 1,735 yds. × 55 yds.

ORAN (La Senia). Lat. 35°37′N., Long. 00°37′W. Altitude 295 ft. Runway E.N.E.-W.S.W. 2,000 yds. × 50 yds.

Tunisia

TUNIS (El Aouina). Lat. 36°50′N., Long. 10°14′E. Altitude 8 ft. Runway E.S.E.-W.N.W. 2,000 yds. × 50 yds.

French Morocco

CASABLANCA (Cazes). Lat. 33°32′N., Long. 07°39′W. Altitude 187 ft. Runway N.E.-S.W. 2,000 yds. × 50 yds.

RABAT. Lat. 34°04′N., Long. 06°45′W. Altitude 248 ft. Runways N.W.-S.E. 2,000 yds. × 50 yds., N.E.-S.W. 2,000 yds. × 50 yds., E.-W. 1,666 yds. × 50 yds.

OUDJDA. Lat. 34°48′N., Long. 01°56′W. Altitude 1,640 ft. Runway N.E.-S.W. 2,000 yds. × 100 yds.

AGADIR. Lat. 30°23′N., Long. 09°43′W. Altitude 150 ft. Runway S.E.-N.W. 1,966 yds. × 50 yds.

Mauretanie

ATAR. Lat. 20°29′N., Long. 13°04′W. Altitude 1,181 ft.

Togoland

LOME. Lat. 06°09′N., Long. 01°14′E. Altitude 72 ft. Runway N.E.-S.W. 2,000 yds. × 50 yds.

French Sudan

GAO. Lat. 16°13′N., Long. 00°04′W. Altitude 867 ft. Runway E.N.E.-W.S.W. 1,666 yds. × 55 yds.

Nigar Colony

NIAMEY. Lat. 13°27′N., Long. 02°18′E. Altitude 650 ft.

Senegal

DAKAR (Ouakam). Lat. 14°43′N., Long. 17°29′W. Altitude 115 ft. Runway N.-S. 1,432 yds. × 85 yds., E.N.E.-W.S.W. 1,370 yds. × 50 yds.

DAKAR (Hann). Seaplanes. Lat. 14°42′N., Long. 17°26′W.

ST. LOUIS. Lat. 16°03′N., Long. 16°27′W. Altitude 7 ft. Runway N.N.E.-S.S.W. 870 yds. × 60 yds.

French Guinea

CONAKRY. Lat. 09°34′N., Long. 13°37′W. Altitude 30 ft. Runways N.E.-S.W. 1,000 yds. × 50 yds., E.-W. 1,030 yds. × 55 yds.

Ivory Coast

ABIDJAN (Port Bouet). Lat. 05°17′N., Long. 03°57′W. Altitude sea level. Runway N.E.-S.W. 1,360 yds. × 55 yds. Also Abidjan seaplane base at Lat. 05°19′N., Long. 04°00′W.

Dahomey

COTONOU. Lat. 06°20′N., Long. 02°23′E. Altitude 6 ft. Runway N.E.-S.W. 980 yds. × 55 yds.

PORTO NOVO. Seaplanes. Lat. 06°28′N., Long. 03°22′W.

Middle Congo

BRAZZAVILLE. Lat. 04°17′S., Long. 15°18′E. Altitude 49 ft. Runway E.S.E.-W.N.W. 1,200 yds. × 60 yds.

POINTE NOIRE. Lat. 04°49′S., Long. 11°55′E. Altitude 50 ft. Runway S.S.E.-N.N.W. 2,200 yds. × 63 yds.

Gabon

PORT GENTIL (Cap Lopez). Lat. 00°43′S., Long. 08°44′E. Altitude 2 ft.

French Cameroons

DOUALA. Lat. 04°02′N., Long. 09°40′E. Altitude 100 ft. Runway S.S.E.-N.N.W. 1,200 yds. × 45 yds.

Ubangi Shari

BANGUI. Lat. 04°22′N., Long. 18°34′E. Altitude 1,476 ft. Runway N.-S. 1,310 yds. × 45 yds.

Tchad

FORT LAMY. Lat. 12°09′N., Long. 15°02′E. Altitude 1,000 ft. Runway N.E.-S.W. 1,435 yds. × 44 yds.

GERMANY

(The German State—Deutsches Reich)

Under the terms of the Potsdam Agreement drawn up by the United Nations in July, 1945, the production in Germany of arms, ammunition and implements of war, including all types of aircraft and sea-going ships shall be prohibited and prevented. The maintenance of all aircraft, military and civil is also prohibited.

The British and U.S. Occupation authorities are planning civil air services in their particular zones, to be operated by a new civil company, routes and services to be based on former Lufthansa operations insofar as present conditions permit.

GREECE

(The Kingdom of Greece—Hellas)

Civil Aviation in Greece is under the control of a Bureau of Civil Aviation, within the Air Ministry. The Chief of the Bureau is Capt. A. Levides.

Since the liberation of Greece there has been no organized Civil Aviation although plans for its reorganization and reformation have been put forward. Application has been made to the Provisional International Civil Aviation Organization (P.I.C.A.O.) for financial and technical aid to establish aviation facilities within the country.

Communications between Athens and Salonica and major Greek towns and islands have been maintained by Greek Air Force aircraft on a courier basis.

GREECE—*continued.*

TRANSPORT COMPANY

Aero Hellas.
Head Office: Athens.
A preliminary agreement has been signed by British European Airways Corpn. and Transcontinental and Western Air, Inc. (T.W.A.) for the organization of a joint British-U.S.-Greek airline to replace the former Greek airline T.A.E. in which T.W.A. had financial and managerial interest.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Greece:—
A.B.A. (Sweden).
B.E.A.C. (Great Britain).
B.O.A.C. (Great Britain).
T.W.A. (U.S.A.).

GUATEMALA

(The Republic of Guatemala—República de Guatemala)

ADMINISTRATION

The control of air transport in the Republic is vested in the Ministry of Commerce, and is the immediate responsibility of a Director-General of Civil Aviation.
Director-General of Civil Aviation: General José Ovidio Sierra C., La Aurora Airport, Guatemala City.

ASSOCIATIONS

Club Interamericano de Universitarios, 10A, Avenida Sur No. 18 Guatemala City.
A non-profit social organization composed of Guatemalan nationals and U.S. citizens resident in Guatelama. In December, 1944, the Civil Aviation Group of the Club was granted exclusive permission by the Government to develop private flying. Ground classes have been started and the Club hopes to obtain a small number of light aeroplanes for flying instruction.

PUBLICATIONS

Alas. Published by the Direccion General de Aeronautica Civil.
Caminos Del Aire. Published monthly by Pan-American Airways.

NATIONAL TRANSPORT COMPANY

Compania Guatemalteca de Aviacion S.A. (Aviateca). Head Office: Guatemala. Manager: M. A. de Paul.
This company is believed to own Ford Trimotor and Douglas DC-2 aircraft.

INTERNATIONAL TRANSPORT COMPANY

The following company operates regular services to and through Guatemala:—
Pan American World Airways (U.S.A.).

AIRPORT

"La Aurora." The principal airport of the Republic. Situated 7 kms. to the South of the capital. Asphalt runway 5,800 ft. × 200 ft. Height above sea level 1,485 m. Wireless telephony, telegraph, and telephone. Meteorological information available.

HAITI

(The Republic of Haiti—La Republique de Haiti)

There is no domestic Civil Aviation in Haiti, but due to its geographical position, the airport and seaplane base at Port au Prince have assumed considerable importance in the Caribbean air services.

Pan American Airways have a number of services using the island. The landplane services from Miami to Buenos Aires, San Juan and Venezuela, all stop at Bowen Field airport and there are also several seaplane services to and through the Port au Prince harbour base. K.L.M. also calls at Bowen Field on its Curaçao—Miami service.

The aerodrome, Bowen Field, although primarily military, has been considerably enlarged and improved by Pan American Airways, who have laid an asphalt runway as well as other facilities. Meteorological data is available from the radio station.

HONDURAS

(The Republic of Honduras—República de Honduras)

ADMINISTRATION

Civil Aviation in Honduras is administered by the Department of War, Marine and Aviation with headquarters at Tegucigalpa.

NATIONAL TRANSPORT COMPANIES

Transportes Aéreos Centro-Americanos S.A. (TACA). Head Office: Tegucigalpa. President: Thomas O. Hardin.
This was the original TACA company founded by Mr. Lowell Yerex in 1930, from which a number of subsidiary companies in other Central and South American countries were built up. All the TACA companies are now controlled by the TACA Airways Agency, Inc., 901, NE 2nd Avenue, Miami, Florida, U.S.A.
Servicio Aéreo de Honduras, S.A. Head Office: Tegucigalpa D.C.

INTERNATIONAL TRANSPORT COMPANY

The following company is operating routes to and through Honduras:—
Pan American World Airways (U.S.A.).

CUSTOMS AIRPORT

Toncontin. Lat. 14°03′N., Long. 87°12′W., Alt. 3,500 ft. 4 miles south of Tegucigalpa. Civil Customs. Runways N.N.W./S.S.E. 1,200 yds., N.E./S.W. 800 yds., N.N.E./S.S.W. 875 yds. Hangars and full night facilities. W/T.
All towns in Honduras with a population of over 500 possess a landing ground.

HUNGARY

Little is known about civil aviation in Hungary since the end of the war. The pre-war Hungarian air traffic company Malert has been dissolved, and in 1946 a new Hungarian-Russian airline company was formed with an initial equipment of five aircraft.

TRANSPORT COMPANY

Magyar-Szovjet Polgari Legiforgalmi Reszvenytarsasag (Maszovlet).
A Hungarian-Soviet company with capital equally owned by the two governments. Part of the Russian capital is provided in form of aircraft (Russian-built DC-3's) and airport equipment.
Began internal operations October, 1946. Until the Peace Treaty was signed no routes were possible outside Hungary.

ICELAND

ADMINISTRATION

Civil Aviation in Iceland is controlled by an Office of Civil Aviation. The Director is Enling Ellingsen.

ASSOCIATION

Flugmalafelag Islands (Iceland Aero Club).
Address: P.O. Box 234, Reykjavik.
Affiliated to the *Fédération Aéronautique Internationale* (F.A.I.).

TRANSPORT COMPANIES

Flugelag Islands H/F. (Iceland Airways, Ltd.). Head Office: Laekjargata 8, Reykjavik. Chairman of the Board: G. Vilhjalmsson. Managing Director and Chief Pilot: Orn O. Johnson.
This company has a total Capital Stock of Ice. Kr. 1,400,000, of which the Icelandic Government owns Kr. 20,000. The remainder is held by private interests.
Loftleidir H/F. (Skyways, Ltd.). Head Office: Reykjavik. Managing Director: Kristjan J. Kristjansson.
This company operates internal services in Iceland.

CUSTOMS AIRPORTS

Reykjavik. Lat. 64°0′N., Long. 21°58′E. Altitude 34 ft. Runways N.-S. 1,570 yds. × 100 yds., N.E.-S.W. 1,380 yds. × 100 yds., E.S.E.-W.N.W. 1,530 yds. × 100 yds.
Keflavik (Meeks Field). Lat. 63°59′N., Long. 22°36′W. Altitude 167 ft. Runways N.-S. 2,190 yds. × 70 yds., N.E.-S.W. 2,210 yds. × 70 yds., E.-W. 2,110 yds. × 70 yds., S.E.-N.W. 2,010 yds. × 70 yds.

IRAN (PERSIA)

(The Kingdom of Iran—Mamalik-i-mahrousseh-i-iran)

NATIONAL TRANSPORT COMPANY

Iranian State Airline. Head Office: Teheran.

This company is 90% Iranian-owned. The remaining 10% is owned by the U.S. company Transcontinental and Western Air, Inc. (Trans World Airline) whose representative Col. S. W. Prouty is in charge of the administration of the Iranian State Airline.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Iran:—

Air France (France).
British Overseas Airways Corpn. (Great Britain).
Soviet Air Lines (U.S.S.R.).

CUSTOMS AIRPORTS

Teheran (Mehrabad). Lat. 35°40′N., Long. 51°25′E. 3 kms. E. of city. Customs facilities. Runways N.N.W.-S.S.E. 6,000 ft. × 150 ft., E.-W. 6,000 ft. × 150 ft.

Kermanshah. Lat. 34°20′N., Long. 47°00′E. 3.5 kms. E. of city. Customs facilities. Runways N.-S. 5,400 ft. × 300 ft., E.-W. 6,000 ft. × 300 ft.

Meshed. Lat. 36°20′N., Long. 59°40′E. 4 kms. S.E. of town. Military and Civil Customs.

Tabriz. Lat. 38°12′N., Long. 46°20′E. 7 kms. N.W. of town. Military and Civil Customs.

Ispahan. Lat. 32°40′N., Long. 51°40′E. 12 kms. S.E. of town.

Bushire. Lat. 29°02′N., Long. 50°42′E. 4 kms. N.E. of town. Customs airport.

Jask. Lat. 25°40′N., Long. 57°45′E. 2.5 kms. N.E. of town. Customs airport.

Djwani. Lat. 25°03′N., Long. 61°46′E. Alt. 100 ft. Customs.

'IRAQ

(The Kingdom of 'Iraq—Mesopotamia)

ADMINISTRATION

Civil Aviation is the responsibility of a Directorate of Civil Aviation. Director: Akram Mushtak. Assistant Director: T. Fattah.

NATIONAL TRANSPORT COMPANY

Iraqi Airways. Head Office: Iraqi State Railways, Baghdad West. Director-General: Major-General H. C. Smith, C.B.E., M.C. General Manager: Lieut. Colonel M. C. P. Mostert. Assistant General Manager: R. M. Hilary. Air Superintendent: Captain E. B. Fielden.

This company is a department of the Iraqi State Railways which are entirely Government-owned. The Directorate consists of the Railway Board of Management. Technical and administrative personnel are seconded from B.O.A.C.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Iraq:—

Air France (France).
British Overseas Airways Corpn. (Great Britain).
Iranian State Airlines (Iran).
K.L.M. (Netherlands).

OTHER OPERATING COMPANIES

The Anglo-Iranian Oil Co., Ltd. and the Iraq Petroleum Co., Ltd. both own aircraft and operate irregular services within the country for the use of their own personnel, the former between Abadan—Basra—Baghdad—Khaniqin, and the latter on their pipe line stations from Kirkuk to Haifa and Tripoli (Syria), using D.H. 89's.

CUSTOMS AIRPORTS

Baghdad West. Customs Airport. 2 miles W. of Baghdad, on right bank of the Tigris. Meteo. Radio. Hangars. Repairs. 875 × 1,560 yds. Runways.

Basrah (Ma'qil). Combined Landplane and Seaplane Customs Airport. 1 mile N. of Basrah. Meteo. Radio. Hangars. Repairs. 1,000 × 1,000 yds. Runways.

Rutbah. Customs Aerodrome. Alongside the Fort of Rutbah. Meteo. Radio.

ITALY

(The Italian Republic—Republica d'Italia)

Civil aviation in Italy was still in a considerable state of flux at the time of writing. Preparations were being made for the establishment of many new semi-nationalised transport companies; meanwhile fare-paying passengers were being accepted on the military courier services. After many delays British European Airways and T.W.A. both signed agreements in Rome on September 16, 1946, for the formation of Italian companies under their sponsorship. A number of smaller companies are being licensed to operate internal services. Although no monopoly will be allowed the Italian Government reserves the right to legislate against uneconomic competition.

ADMINISTRATION

The Director of Civil Aviation, Dr. S. Cacopardo-Melita, comes under the Air Minister, Mario Cingolani.

ASSOCIATION

Aero Club d'Italia (replaces R.U.N.A.). President: Luigi Gasparotto. Vice-President: Lieut. Col. of the Air Force, Piero Guiliani. Secretary: Giuseppe Fantappie.

NATIONAL TRANSPORT COMPANIES

Aero Linee Italiane Internazionale.

Head Office: Aeroporto del Littorio, Rome. Chairman: Signor de Michalis. Vice-chairman: Air Cdre. Whitney Straight, C.B.E., M.C., D.F.C.

This is the British sponsored company with a capital of £1,000,000, 40% of which is provided by B.E.A.C. The Italian contribution includes all the assets of the old Italy-South American airline L.A.T.I. When overseas operations are started, this route will be revived, but internal services will be the first to be operated. Technical services and commercial representation for B.E.A.C. in Italy will be undertaken. Personnel will be Italian with British technical advisers. Although some aircraft will be British, the majority are to be Italian.

Linee Aeree Italiane. Head Office: Rome. President: Luigi Casparutto.

This is the American-sponsored company with a capital of 1,000,000,000 Lire, in which T.W.A. has a 40% interest. Unlike the British-sponsored company, L.A.I. is only to operate internal services in Italy.

Aereo Teseo. S.A. Head Office: Florence.

This company plans to operate internal services.

Avio Linee Italiane. S.A. Head Office: Via 9 Maggio 10, Turin. Traffic Manager: Dr. Alessandro Buzio.

This pre-war Italian air transport company has a capital of 12,000,000 Lire and is associated with the Fiat Group.

Soc. Italiana Servizi Aerei. Head Office: Trieste. Manager: Dr. Paulo Consulich.

This company, which was the first airline to operate and was absorbed into the now defunct Ala Littoria, is being reconstituted.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Italy:—

A.B. Aerotransport (Sweden).
British Overseas Airways Corpn. (Great Britain).
British European Airways Corpn. (Great Britain).
Trans World Airline (TWA) (U.S.A.).
Soviet Air Lines (U.S.S.R.).

JAPAN

(The Japanese Empire—Nippon)

On August 10, 1945, Japan accepted the terms of unconditional surrender drawn up by the United Nations at Potsdam in July. These terms include the prohibition and prevention of the production of arms, ammunition and implements of war, as well as all types of aircraft and sea-going ships. The maintenance of all aircraft, military and civil, was also prohibited.

However, in September, 1945, Allied permission was given for the Japanese operation of four internal services under contract to the occupational authorities and for the carriage of Government and military officials.

Japan Airways has maintained a skeleton headquarters at Fukuoka and was reported to be seeking permission from General MacArthur to restart operations, initially with a service to Tokyo. Four Douglas DC-3's and one Mitsubishi MC-20 were said to be available. It has been revealed that at its peak Japan Airways, with a monopoly of Japanese air transport, possessed some 260 aircraft, 150 of which were Douglas DC-3s and the remainder Mitsubishi MC-20's. Its routes served many of the points reached by the Japanese Army, including the Dutch East Indies and New Britain.

LEBANON

(The Republic of Lebanon—Republique Lebanaise)

NATIONAL TRANSPORT COMPANY

Middle East Airlines. Head Office: Beirut. Chairman: Said Salaam Bey. Technical Director: Fawzi el Hossbey. Senior Pilot: Capt. Tetterborn (Seconded from B.O.A.C.).

This company has an agreement with B.O.A.C. for technical and administrative assistance.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through the Lebanon:—

Air France (France).
British Overseas Airways Corpn. (Great Britain).
Iraqi Airways (Iraq).
Misr Airlines (Egypt).

MEXICO

(The United States of Mexico—Estados Unidos Mexicanos)

ADMINISTRATION

Civil Aviation in Mexico is under the control of the Secretariat for Communications and Public Works. The Secretariat, through its Department of Aerial Communications, regulates and co-ordinates the services of the various air transport companies, private flying, etc. Director of Civil Aviation: Ing. Juan Guillermo Villasana.

PUBLICATIONS

Aviacion. Published in Mexico City. Editor: Ing. Fernando Monasterio.
El Piloto. Published in Tijuana (Baja California).

NATIONAL TRANSPORT COMPANIES

Aeronaves de Mexico, S.A. Head Office: Juarez 97, Mexico City. President: Antonio Diaz Lombardo.

This company is associated with Pan American World Airways (U.S.A.).

Aero-Transportes, S.A. Head Office: Gante 2-504, Mexico City. President: Pedro Maus. General Manager: Edmundo Stierle.

Aero Transportes del Sureste. Head Office: Campeche.

Aerovias Braniff, S.A. Head Office: Edificio Internacionale, Apartado Postal No. 1441, Mexico City. President: T. E. Braniff.

This company is sponsored by Braniff International Airways (U.S.A.) with whose services it connects at Nuevo Laredo.

Aerovias Internacionales. Head Office: Mexico City. President: Alberto R. Pani.

Formed in February, 1946, and authorised to operate scheduled passenger, freight, and mail services.

Aerovias Transportes de Sonora. Head Office: Edificio Ferreira, Despacho No. 1., Hermosillo.

American Airlines de Mexico, S.A. Head Office: Avenido Ejido No. 7, Mexico City. President: C. R. Smith.

This is not an operating company but acts as the Mexican agents for American Airlines.

Compania Mexicana de Aviacion, S.A. Head Office: Bolivar 21, Mexico City. President: Aaron Saenz.

This company was formerly controlled by Pan American Airways (U.S.A.) but it is now completely Mexican-owned.

Comunicaciones Aereas de Veracruz, S.A. Head Office: Edificio Internacionale, Paseo de la Reforma No. 1, Mexico City. President: William T. Churchill Morgan.

Golfo y Pacifico Aerotransportes. Head Office: Mario Molina 48, Vera Cruz. President: Ing. Valentin Q. Gama.

Lineas Aereas Mexicanas, S.A. Head Office: Edificio Internacional, Paseo de la Reforma No. 1, Mexico City. President and General Manager: Allan F. Bonnalie.

This company is associated with United Air lines (U.S.A.).

R.G.M. Head Office: Mexico City.

This is a Mexican controlled company with a capital of 10,000,000 Pesos which was formed by Ricardo Gonzalez Montero whose initials form its name.

Red Aerea Mexicana, S.A. Head Office: Palma Norte 519, Despachos 501-506, Mexico City.

Servicio Aereo Panini. Head Office: Edificio Pasaje America, Mexico City. President and General Manager: Carlos Panini.

Servicio Aereos Nacionales. Head Office: Mexico City. Owner: Juan Tilghman, Jr.

TACA de Mexico, S.A. Head Office: Motolinia 6, Mexico City. President: Angel Tavera.

This is not an operating company but agents for the T.A.C.A. organisation whose aircraft pass through Mexico *en route* from the U.S.A. to Central and South America.

Transportes Aereos de Jalisco. Head Office: Pedro Moreno No. 463, Guadalajara. President: Gral. R. F. Villalobos.

Transportes Aereos de Tampico, S. de R.L. Head Office: Fray Andres de Olmos No. 111 Norte, Tampico. President and Manager: P. A. Felipe Gutierrez de Lara.

Transportes Aereos Mexicanos, S.A. Head Office: Madero 29 Desp. 301, Mexico City. President: Ing. A. P. Canton.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Mexico:—

American Airlines (U.S.A.).
Braniff International Airways (U.S.A.).
Pan American World Airways (U.S.A.).
T.A.C.A. (Honduras).

CUSTOMS AIRPORTS

Agua Caliente (Tijuana). Customs. 3.5. km. S.E. of Agua Caliente, B.C. 32°32′N., 117°32′W. Radio. 700 × 500 m. Alt. 10 m.

Chihuahua. Customs. 2 km. N.W. of Chihuahua. 28°38′N., 106°05′W. Alt.: 1,430 m.

Ensenada. Customs. 2 km. N.E. of Ensenada, Baja California. 31°51′N., 116°35′W. 2,000 × 700 m. Alt.: 10 m.

Guaymas. Customs. 6 km. N.W. of Guaymas, Sonora. 27°55′N., 110°53′W. 750 × 450 m. Alt.: 10 m.

Hermosillo. Customs. 2.5 km. N. of Hermosillo, Sonora. 29°07′N., 110°56′W. 1,250 × 700 m. Alt.: 230 m. Runways. Airport of Entry.

Matamoros. Customs. On Texas-Mexican border at Matamoros, Tamaulipas.

Mazatlán. Customs. 3.5 km. N.W. of Mazatlán, Sinaloa. 23°14′N., 106°25′W. 750 × 550 m. Radio. Alt.: 10 m.

Merida. Customs. 6 km. S.W. of Merida, Yucatan. 20°58′N., 89°38′W. 1,000 × 650 × 500 m. Runways. Radio. Hangar. Alt.: 20 m.

Mexicali. Customs. E. of Mexicali, Baja California. 32°38′N., 115°29′W. 1,100 × 700 m. Runways. Alt.: S.L. Airport of Entry.

Mexico City. Customs. 4 km. E. of Mexico City. 19°25′N., 99°05′W. 810 × 840 × 450. Runways. Radio. Alt.: 2,240 m. Hangars. Repairs. Full night facilities.

Nuevo Laredo. Customs. 1.5 km. N.W. of Laredo, Tamaulipas. 27°29′N., 99°31′W. 550 × 515 m. Alt.: 94 m.

Tampico. Customs. 8.5 km. N. of Tampico, Tamaulipas. 22°17′N., 97°52′W. 760 × 645 m. Radio. Repairs. Alt.: 20 m. Hangar.

Tapachula. Customs. 5 km. S.E. of Tapachula, Chiapas. 14°54′N., 92°15′W. 700 × 680 m. Alt.: 182 m.

NETHERLANDS

(The Kingdom of the Netherlands—Nederland)

ADMINISTRATION

Civil Aviation is controlled by the "Aeronautical Service of the Netherlands" (Rijksluchtvaartdienst) under the Ministry of Transport. **Director-General**: H. Ch. E. van Ede van der Pals. Address: Binnenhof 20, The Hague. Telephone 182670.

The Aeronautical Service of the Netherlands consists of four departments:—**Technical Department** (Chief: J. W. F. Backer); **Juridical and Political Department** (Acting Chief: Dr. H. J. Spanjaard); **Air Traffic Control Department** (Chief: S. L. Hof); and **Administrative Department** (Chief: J. J. van Drecht).

NATIONAL TRANSPORT COMPANY

Koninklijke Luchtvaart Maatschappij voor Nederland en Kolonien N.V. (K.L.M.—Royal Dutch Airlines). Head Office: 90, Raamweg, The Hague. President: Dr. Albert Plesman. Managing Director and Technical Director: H. Veenendaal.

Incorporated in 1920, K.L.M. is partly State-owned and partly owned by private persons. Despite the enemy occupation of Holland, K.L.M. continued operations through the war years with headquarters in London. Following the Liberation of Holland the Dutch Government were the nominal operators of all air transport. Control has been gradually handed over to K.L.M., and by the end of 1946 the only Government route remaining was that from Holland to the Dutch East Indies, which was operated under charter by K.L.M.

In 1946, K.L.M. routes were expanded very greatly and the network became far greater than in 1939. A trans-Atlantic

NETHERLANDS—*continued.*

service was started to New York and proving flights were made to South America and South Africa.

CHARTER COMPANY

Frits Diepen Vliegtuigen N.V.
Head Office: The Hague.
Airport: Ypenberg.
Operates non-scheduled charter flying, air-taxi services, etc.

FOREIGN TRANSPORT COMPANIES

The following companies are operating routes to or through the Netherlands:—

A.B.A. (Sweden).
Air France (France).
British European Airways Corpn. (Great Britain).
C.S.A. (Czechoslovakia).
D.N.L. (Norway).
S.A.B.E.N.A. (Belgium).
Swissair (Switzerland).

ASSOCIATION

Koninklijke Nederlandsche Vereeniging voor Luchtvaart (Royal Aero Club of the Netherlands). Office: Anna Paulownaplein 3, The Hague. Affiliated to the *Fédération Aeronautique Internationale* (F.A.I.). President: Dr. Ir. M. H. Damme. General Secretary: J. Nontauban van Swijndregt.

FLYING SCHOOLS

Netherlands Government Aviation School.
Managing Director: Mr. J. A. Bach.

Established by the Ministry of Transport—Civil Aviation Department. Opened April 8, 1946. Based at the aerodromes of Gilze-Rijen and Ypenburg, the latter for primary flight training.

In its embryonic state and for the time of acute shortage of civil pilot-navigators the school is intended for an urgent training programme of 300 pilot-navigators during the next two or three years. Therefore, the school has started with 75 students and will absorb further courses of 75 students every six months. The complete course will last about 18 months, so that after April, 1947, the total number of students attending the school and lodged in the training camp will be approximately 225.

After having completed the course, students will leave the school with a total of 300 flying hours, "B" licence, 2nd class Navigator certificates, and be fully trained for 1st Class Navigator's certificates, but without being examined for this licence.

The training material consists of 23 Tiger Moths, 12 Harvards 8 Beechcraft D18 S and 3 Junkers Ju 52 (war booty).

It is hoped that the school can be removed to the aerodrome of Deelen (near Arnhem) at the beginning of 1948. There will also be training schools for mechanics and wireless operators. In addition, courses and training for "A" Licence (sports) will be held. Eventually the school will be fully self-supporting in respect of repairs and maintenance of the aircraft and their instruments, wireless and meteorological services, etc.

N.V. Nationale Luchtvaartschool (The National School of Flying Ltd.). Manager: J. Montauban van Swijndrecht. Headquarters: Ypenburg Aerodrome, Rijswijk.

This company, founded in 1927, had to close down during the war, but reopened the school in June, 1946.

The N.V. Nationale Luchtvaartschool does all the flying and instruction for the Netherlands Aero Clubs.

PUBLICATIONS

Vliegwereld (Twice monthly). Popular aeronautical illustrated paper. Address: Gedempte Oude Gracht 138, Haarlem. Price: HFl. 7.50 a year.

Avia (Twice monthly). Popular aeronautical illustrated paper. Address: Anna Paulownaplein 3, Den Haag. Official Organ of the Royal Aeroclub of the Netherlands. Price: Hfl 6,00 a year.

AIRPORTS

SCHIPHOL (Amsterdam). Lat. 52°18.5′N., Long. 4°48.5′E. 8 kms. S.W. of the centre of Amsterdam. Altitude 4 m. below sea-level. Runways N.E.-S.W. 1,500 m. (will be lengthened to 2,150 m.), N.-S. 850 m., E.-W. 1,400 m., N.W.-S.E. 1,300 m. Civil Customs aerodrome available for public use, including international air traffic. Destined for trans-oceanic, trans-continental, international and national civil air traffic with commercial aircraft. Controlling authority: Municipality of Amsterdam. Hangers, aviation fuels, all repairs, medical assistance, restaurant, wireless, D/F, lighting, wind-indicator, weather report station.

EELDE. Lat. 53°07.5′N., Long. 6°35′E. 8.8 kms. S. of Groningen railway station. Altitude 5.6 m. above sea-level. Landing area E.-W. 700 m., N.-S. 650 m. Civil aerodrome. available for public use. Controlling authority: N.V. Luchtvaartterrein voor Noord-Nederland. Hangers, aviation fuels, minor repairs, first aid station, restaurant, wireless, D/F, wind-indicator. Available for gliding.

EINDHOVEN. Lat. 51°26.5′N., Long. 5°24.5′E. Altitude 20.3 m. above sea-level. Runways 210° 1,600 m., 270° 1,600 m., 340° 1,200 m. Customs aerodrome. Available for public use, including international air traffic. Controlling authority: Municipality of Eindhoven. Hangars, aviation fuels, minor repairs, first aid station, restaurant, wireless, D/F, wind indicator. Night-landing arrangements on request.

LEEUWARDEN. Lat. 53°13.5′N., Long. 05°46′E. 3 kms. N.E. of the centre of Leeuwarden. Altitude 0.40 m. above sea-level. Landing area E.-W. 600 m., N.-S. 600 m. Runways N.E.-S.W. 1,600 m. (1,100 m. ready for use), E.-W. 1,550 m. (not yet available), S.E.-N.W. 1,500 m. (ready for use 800 m.). Available for public use. Controlling authority: Municipality of Leeuwarden. Hangar, aviation fuels, first aid station, wireless, wind indicator.

TWENTE. Lat. 52°16′N., Long. 06°53′E. 5.5 kms. N. of Enschede. Altitude 31 m. above sea-level. Runways E.S.E.-W.N.W. 1,500 m., N.N.W.-S.S.E. 1,650 m., N.E.-S.W. 1,600 m. Available for public use. Controlling authority: N.V. Luchtvaartterrein Twente. Hangars, aviation fuels, first aid station, wireless, D/F, wind-indicator, night-landing facilities on request.

ZUID-LIMBURG. Lat. 50°55′N., Long. 05°45.5′E. 9 kms. N.N.E. of the centre of Maastricht, 3 kms. of the E. bank of the river Maas. Altitude 114 m. above sea-level. Runways N.E.-S.W. 1,300 m., E.S.E.-W.N.W. 760 m. Available for public use. Controlling authority: Temporary Provinciale Waterstaat. Wireless, wind-indicator.

NETHERLANDS EAST INDIES

(Nederlandsch-Indië)

TRANSPORT COMPANY

Koninklijke Nederlandsche Indische Luchtvaart Maatschappij (K.N.I.L.M.—Royal Netherlands Indies Airline Company).

On the occupation of the East Indies by Japan in March, 1942, most of the personnel of K.N.I.L.M. and eleven of its aircraft were evacuated to Australia. The aircraft were handed over to the U.S. Air Transport Command and the crews served with this command. In 1943, the personnel of K.N.I.L.M., reinforced with trained Dutch crews from the flying school at Jacksonville, Miss., U.S.A., were formed into a squadron known as the Netherlands East Indies Transport Squadron (N.E.I.T.S.), and this squadron was placed under the operational control of the Allied Air Force Command in Australia. It flew freight and passengers to all northern areas where Netherlands personnel were operating during the Pacific war. In 1945, the squadrons' name was changed to No. 19 Transport Squadron, R.A.A.F.

Since the defeat of Japan the political situation in Java has been prohibitive to the return of the normal circumstances essentially necessary for the revival of K.N.I.L.M. and the resumption of its ambitious pre-war plans. No. 19 Transport Squadron continues to operate an inter-island air network, as well as services to Australia, Manila, P.I., and Bangkok, Siam.

K.N.I.L.M. is, however, preparing for the future. It is assumed that the company will resume operations under a Government charter and then gradually return to private enterprise, eventually to operate an inter-island system of double pre-war scale, together with extensive international air routes.

Communications with Europe are maintained by the European K.L.M. Company operating under charter to the Netherlands Government. This service is for Government-sponsored passengers and freight only.

NETHERLANDS WEST INDIES

(The Islands of Curaçao, Aruba and Bonaire)

ADMINISTRATION

Civil Aviation in the Netherlands West Indies is under the jurisdiction of the Director of Public Works, assisted by an Inspector of Civil Aviation. Headquarters: Willemstad, Curaçao, N.W.I.

TRANSPORT COMPANY

K.L.M. Royal Dutch Airlines (Compania Real Holandesa de Aviacion), West Indies Division. Address: 3 de Ruyterkade, Willemstad, Curaçao, N.W.I.

This company commenced operations in the Caribbean in 1934 and since then its route-mileage has increased from 73 to 5,963 miles in 1945.

Since June 6, 1946, Curaçao has been linked with Europe by a weekly K.L.M. service flying from Amsterdam to Curaçao, with a technical stop in New York.

NETHERLANDS WEST INDIES—*continued.*

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating regular services to and through the Netherlands West Indies :—

Linea Aeropostal Venezolana (Venezuela).
Pan American World Airways (U.S.A.).

AIRPORTS

Curaçao (Hato). Lat. 12°11′N., Long. 86°58′W. 4½ miles N.N.W. of Willemstad, on coast N.W. of oil refinery. Altitude 27 feet. Runways W.N.W./E.S.E. 5,000 × 200 ft., E.N.E./W.S.W. 2,132 × 200 ft. Aeradio (24 hours service). Radio beacon PJG 343 (10 miles east of field). Night landing facilities, boundary lights, obstruction lights, rotating beacon. Airport building. Customs airport of entry. Hangars and K.L.M. repair shops in S.E. corner.

Aruba (Dakota). Lat. 12°30′N., Long. 70°01′W. 2½ miles S.E. of Oranjestad. Altitude 39 feet. Runways E.W. 5,300 × 200 ft., N.E./S.W. 2,100 × 200 ft. Aeradio (hours of daylight only). Radio beacon PJH 333 kc. (on airport). Night landing facilities, boundary lights, obstruction lights. Airport building. Customs airport of entry.

Bonaire (Kralendijk). Lat. 12°13′N., Long. 68°15′W. Altitude 147 ft. Runway W.N.W./E.S.E. 3,280 × 165 ft. Radio service on request. Airport Building.

St. Maarten (Prinses Juliana). Lat. 18°02′N., Long. 63° 06′W. Runway E./W. 4,000 ft. Radio service on request. Airport building.

SURINAME
(Dutch Guiana)

There is no internal aviation, but the Colony is served by K.L.M. and Pan American World Airways. The former company runs a regular service between Curaçao and Paramaribo via Port of Spain. The Pan American Airways service from Miami to Buenos Aires makes a stop at Paramaribo.

CUSTOMS AIRPORT

Paramaribo (Zanderij). Lat. 5°28′N. Long. 55°12′W. 25 miles S. of Paramaribo alongside E. side of railway. Alt. 10 ft. 1,750 × 875 yds.

SEAPLANE BASE

Pan American Airways' base is situated on right bank of the Suriname river just below Paramaribo. There is a slipway and a barge. W/T. by arrangement with P.A.A.

NICARAGUA

(The Republic of Nicaragua—República de Nicaragua)

ADMINISTRATION

Civil Aviation in Nicaragua is controlled by the Ministerio de Guerra, Marina, y Aviacion in Managua. The Inspector for Civil Aviation is Mayor Piloto Aviador Rafael Espinosa Altamirano.

NATIONAL TRANSPORT COMPANY

Compania Nacional TACA de Nicaragua, S.A. Head Office: Managua. President and General Manager: Thomas O. Hardin.

This is the local Nicaraguan company of the TACA organization.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Nicaragua :—

Pan American World Airways (U.S.A.).
T.A.C.A. (Honduras).

CUSTOMS AIRPORTS

Managua. Lat. 12°08′N., Long. 86°16′W. Civil Customs. 1½ miles S.E. of town. Alt. 150 ft. Size 2,250 × 1,320 ft. Administrative building and hangars. Minor repairs. W/T.

Ocotal. Lat. 13°37′N., Long. 86°31′W. 1½ miles W.S.W. of town. Customs airport of entry. Alt. 1,500 ft. Two strips N./S. 2,000 × 400 ft. and N.E./S.W. 1,200 × 100 ft.

NORWAY

(The Kingdom of Norway—Norge)

ADMINISTRATION

Civil Aviation in Norway comes under the control of the Ministry of Defence. The Office of Civil Aviation (Forsvarsdepartementet, luftfartsavdelingen) is at Storgaten 33, Oslo, and the Director of Civil Aviation is Mr. E. Boe.

ASSOCIATION

Norsk Aero-Klub. Address: Ovre Slottsgate 20, Oslo. Affiliated to the *Fédération Aéronautique Internationale* (F.A.I.).

NATIONAL TRANSPORT COMPANIES

Det Norske Luftfartselakap A/S. (D.N.L.) (Norwegian Air Lines). Head Office: Fridtjof Nansens plass 8, Oslo. Chairman of the Board: Thomas Falck. Chairman—Executive Committee: Thomas Olsen. Managing Directors: Berbt Balchen and Per M. Backe.

The original D.N.L. company was formed in 1933 to operate all scheduled airlines in and from Norway to other European countries, but with the occupation of Norway in 1940 all activities were suspended. In 1943, the Norwegian Government established a Government agency, the Royal Norwegian Air Transport (R.N.A.T.), to operate interim services and to take care of Norway's interests in future civil aviation. This organization operated the home and European services up to February 10, 1946.

A Royal Decree dated January 18, 1946, established a new D.N.L., which company was subsequently authorised to operate all internal and foreign air services on a 20-year concession.

D.N.L. is a private company with a capital mainly provided by Norwegian shipping companies, although the Government hold up to 25% of the total share capital.

D.N.L. participates in the Scandinavian Airlines System in pool with S.I.L.A. (Sweden) and D.D.L. (Denmark), and operates two Douglas DC-4 aircraft on this Scandinavian trans-Atlantic service.

South America and Far East Air Transport Co. Head Office: Hieronimus Heyerdahlaget, 1. Managing Director: L. G. Braathens.

This company was formed by the five Braathens Shipping Companies, has a capital of 4,000,000 Kroner and a fleet of three Douglas DC-4s. It intends to develop a "tramp" service primarily for the carriage of cargo all over the World.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Norway :—

A.B. Aerotransport (Sweden).
American Overseas Airlines (U.S.A.).
British European Airways Corporation (Great Britain).
Det Danske Luftfartselskab (Denmark).
K.L.M. (Netherlands).
S.A.B.E.N.A. (Belgium).

CUSTOMS AIRPORTS

Oslo (Fornebu). Lat. 59°54′N., Long. 10°37′E. Altitude 60 ft. Runways 012°-192° 1,370 yds. × 55 yds., 056°-236° 1,280 yds. × 55 yds., 142°-322° 756 yds. × 44 yds.

Oslo (Gardermoen). Lat. 60° 11′N., Long. 11°05′E. Altitude 666 ft. Runways N.N.E.-S.S.W. 2,200 yds. × 55 yds., E.S.E.-W.N.W. 2,200 yds. × 85 yds., N.E.-S.W. 1,400 yds. × 30 yds.

Stavanger (Sola). Lat. 58°53′N., Long. 05°38′E. Altitude 30 ft. Runways 042°-222° 2,200 yds. × 45 yds., 114°-294° 1,900 yds. × 130 yds., 143°-323° 1,900 yds. × 45 yds.

Trondheim (Vaernes). Lat. 83°27′N., Long. 10°56′E. Altitude 25 ft. Runway N.-S. 1,270 yds. × 88 yds., E.-W. 1,750 yds. × 88 yds., S.E.-N.W. 1,400 yds. × 88 yds.

CUSTOMS SEAPLANE BASE

Kristiansand (Kjevik). Lat. 58°12′N., Long. 08°04′E.

PANAMA

(The Republic of Panama—Republica de Panama)

ADMINISTRATION

Civil Aviation is under the control of the Comision Nacional de Aviacion, Palacio Nacional, Panama, R.P. The Technical Adviser in charge of Civil Aviation is Jaime E. Smith Pezet, Ministro de Gobierno y Justicia, Panama.

ASSOCIATIONS

Club Nacional de Aviacion, Aeropuerto Nacional, Panama, R.P. Principal Official: Dr. Adolfo Arias.

Club Americano, Aeropuerto Nacional, Panama, R.P. Principal Official: Mr. J. Hearn.

NATIONAL TRANSPORT COMPANY

T.A.C.A. Airways, S.A. Head Office: Panama City. Chairman of the Board: Benjamin F. Pepper. President: Julius C. Holmes.

This company represents the TACA organization in Panama.

PANAMA—*continued.*

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Panama and the Canal Zone :—

Pan American World Airways (U.S.A.).
Pan American Grace Airways (U.S.A.).
T.A.C.A. (Honduras).
Uraba, Medellin and Central Airways (Colombia).

CUSTOMS AIRPORTS

PAITILLA AIRPORT, Panama City. Customs Airport. 2¼ miles N.E. of Panama City. Altitude 40 ft. Two concrete runways N./S. 2,500 ft. × 450 ft., E./W. 2,100 ft. × 260 ft. and one runway N.E./S.W. 2,500 ft. × 420 ft. in poor condition. Wind cone to North. Boundary lights only. W/T.

DAVID. Lat. 8°23′N., Long. 82°26′W. Customs Airport. Altitude 90 ft. Hangar. W/T. Call sign NEB. Wave length 55.8 m. No runways. No night-landing facilities.

PANAMA CANAL ZONE (U.S.)

ADMINISTRATION

The Panama Canal Zone is administered by the United States of America. No private transport companies are established within the Canal Zone. Pan American Airways and Pan American-Grace Airways serving the Zone use the U.S. Army Air Forces aerodrome at Albrook Field, Balboa.

Aeroplanes of the Republic of Panama are not permitted to use the Canal Zone airports. Under present conditions, these aircraft are no longer permitted to fly over the Canal, and upon leaving the Republic of Panama must proceed northwards towards David and make course to Taboga Island and from there back to the mainland.

There are also U.S. Army Air Forces aerodromes at Rio Hato, R.P., and Howard Field and a U.S. Naval Air Base at Coco Solo, C.Z.

PARAGUAY

(The Republic of Paraguay—República del Paraguay)

ADMINISTRATION

Civil Aviation in Paraguay is controlled by the Ministry of War and Marine at Asunción. Director-General of Aeronautics : Major Pablo Stazni.

ASSOCIATION

Aero Club del Paraguay. Formed early in 1938. Its activities are largely promoted by Government officials and Army officers.

NATIONAL TRANSPORT COMPANIES

Linea Aerea de Transporte Nacional.
This airline was organized in 1944 by the Paraguayan Army Air Force.

Aerovias Paraguayas S.A.
This is a TACA subsidiary. The local operators are Messrs. Navarro and Ladonch, who formerly operated a taxi service with Waco biplanes.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating to and through Paraguay :—

Pan American World Airways (U.S.A.).
Panair do Brasil (Brazil).

CUSTOMS AIRPORT

CAMPO GRANDE (Asunción). Military. 11 kms. E. of city. 1,000 × 1,270 m.

CAMPO PANAIR (Asunción). Private. 11 kms. E. of city. 1,400 × 1,200 m.

AERO CLUB (Asunción). Civil. 11 kms. E. of city. 600 × 500 m.

The above three airfields adjoin each other.

PERU

(The Republic of Peru—República del Perú)

ADMINISTRATION

Civil Aviation in Peru is controlled by "Dirección de Aeronáutica," Comandancia General de Aeronáutica, Miraflores, Lima, Peru, through the appropriate Department, i.e., "Dirección de Aviación Comercial y Civil." The Jefe de Aviación Comercial y Civil is General de Aeronautica Carlos A. Gilardi.

ASSOCIATIONS

Aero Club del Peru, Girón de la Unión No. 722, Lima.
President : General de Aeronautica Fernando Melgar C.
Formed September, 1935. The Club has a large membership and operates a flying instruction school for members at Limatambo Aerodrome, Loma.

Liga Nacional de Aviación (National Aviation League)
Temporary Address : Edificio Piedra, Calle Baguijano No. 722, Lima.
Organized early in 1941 by patriotic citizens and financed by popular subscription, with the support of the President and Cabinet Ministers. It owns an aerodrome with hangers and workshop, etc., and forms the Reserve of the Peruvian Air Force. Training is given by military personnel.

PUBLICATIONS

Aviacion. Director : Comandante de Aeronáutica Augusto Correa Santistevan, Real Felipe, Callao. Postal Address : Apartado No. 370, Callao. Published monthly. Price : 0.50 cts.

Boletin de la Direccion de Aviacion Comercial y Civil. A Government bulletin issued free every three months, giving details regarding new regulations and statistics, etc., on Commercial and Civil Aviation.

NATIONAL TRANSPORT COMPANIES

Compania de Aviacion "Faucett" S.A. Head Office : Hotel Bolivar 926, Lima. President : Eduardo Dibos. Managing Director : Elmer J. Faucett.
This company has its operational headquarters at Santa Cruz Airport, which it owns. It has its own aircraft factory as well as workshops where all maintenance and engine overhauls are undertaken by Peruvian labour. It also owns Trujillo Airport.

Aerovias Peruanas Internacionales (Peruvian International Airways).
This company was formed in March, 1946, with 40% of the capital owned by the Peruvian Government, the remaining 60% being equally divided between Canadian and U.S. interests. It is intended to use as many Peruvian personnel as possible but until sufficient have been trained, North American technical and flying personnel will be used. The Company's operational headquarters are at Limatambo and Parambo in Lima where hangars, workshops, offices, etc., are under construction. The company has acquired 5 Douglas DC-4s (C-54s) and will operate both national and international routes.

Linea Aerea Nacional (L.A.N.), c/o. Commandancia General de Aeronautica, Miraflores, Lima.
This airline is operated by the Peruvian Air Force as a transport and training service.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Peru :—

Pan American-Grace Airways (U.S.A.).
Panair do Brasil (Brazil).

AIRPORTS

LIMATAMBO. The chief airport of Peru. 4 kms. S.S.E. from the city of Lima. It is an up-to-date and modern civil airport, has large hangar, workshops, fuel depot, customs offices, dispatch section, radio station, hotel, and an excellent car service to the city. It is open day and night.

Customs airfields are situated at TACNA, PUNO, IQUITOS and TALARA.

POLAND

(The Polish Republic—Rzeczpospolita Polska)

ADMINISTRATION

Civil Aviation in Poland is controlled by the Ministry of Communications.

ASSOCIATION

Aeroklub Polskiej (Polish Aero Club). Address : ul. Chaubinskiego 4, Warsaw.
Affiliated to the *Fédération Aéronautique Internationale* (F.A.I.).

TRANSPORT COMPANY

Polskie Linje Lotnicze.
Head Office : Warsaw.
Polskie Linje Lotnicze is the national transport company and successor to the pre-war company of the same name. It operates mainly within the Russian sphere of influence and benefits from air transport agreements concluded between the Polish and the Russian and Czechoslovak Governments. Its equipment consists of Russian-built DC-3 airliners.

INTERNATIONAL AIRPORT

WARSAW (Okecie). Lat. 52°11′N., Long. 20°58′E. Altitude 104 m. Runways W.N.W.-E.S.E. 1,968 yds. × 43 yds.

PORTUGAL

(The Republic of Portugal—Republica Portuguesa)

ADMINISTRATION

Civil Aviation has, since January 1, 1947, been under the administration of the Ministry of Communications, and is controlled by a Directorate of Civil Aviation. The Minister of Communications is Senor Cancela de Abreu.

ASSOCIATION

Aero Club de Portugal, 226, Avenida da Liberdade, Lisbon. Founded: 1909. Affiliated to the *Fédération Aéronautique Internationale.*

All the provincial clubs are affiliated to and under some measure of control of the Aero Club de Portugal.

PUBLICATION

Revista do Ar, published monthly from 226, Avenida da Liberdade, Lisbon. Director and Editor: Lieut.-Aviator Armando Correira Mera.

NATIONAL TRANSPORT COMPANIES

Aero Portuguesa Ltda. Head Office: Rue do Alecrim 33, Lisbon. Manager: Commander J. Judice de Vasconcellos.

This old-established company is controlled to a great extent by the large Portuguese shipping company, Companhia Nacional de Navegaçao.

Companhia de Transportes Aereos. Head Office: Avenida da Liberdada 72A, Lisbon. Board of Directors: Manuel de Mello and Dr. Luiz de Sousa Lara. Managing Director: Corlos E. Bleck.

This company was formed in 1945 with a capital of 5,000,000 Escudos in 1945. The only route it was operating in the Summer of 1946 was from Lisbon to Operto, but it has applied to the Government to operate services to Spain, France and Great Britain, as well as to South America and to Portuguese colonies in Africa.

Military Service. The Portuguese Military Air Force operates courier services from Portugal to the Azores and also between the islands.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Portugal:—

A.B.A. (Sweden).
Air France (France).
British European Airways (Great Britain).
British Overseas Airways (Great Britain).
British South American Airways (Great Britain).
Flota Aerea Mercante Argentina (Argentina).
Iberia (Spain).
K.L.M. (Netherlands).
Pan American World Airways (U.S.A.).
S.A.B.E.N.A. (Belgium).
T.W.A. (U.S.A.).

AIR SURVEY COMPANY

Sociedade Portuguesa de Levantamentos Aéreos, Ltda. (S.P.L.A.L.) Rua da Escola Politécnica, 61-63, Lisbon. This Company continues to undertake aerial survey work, principally overseas.

CUSTOMS AIRPORT

Lisbon (Portela de Sacavem). Lat. 38°46'N., Long. 09° 08'W. 4 miles N. of the centre of Lisbon and 2 miles from the Cabo Ruibo seaplane base. Height above sea level 328 ft. Four runways N.-S. 1,280 yds. × 55 yds., N.E.-S.W. 1,476 yds. × 55 yds., E.-W. 1,120 yds. × 55 yds., S.E.-N.W. 1,316 yds. × 55 yds. Opened to air traffic in October, 1942.

SEAPLANE BASE

The Cabo Ruivo seaplane base is situated approximately 4 miles N.N.E. of Lisbon. Although still considered provisional, it will probably become the permanent seaplane base, having very adequate equipment and no more suitable site being available.

ANGOLA

(Portuguese West Africa)

ADMINISTRATION

By a Decree issued by the Governor-General of the Colony the Conselho de Aéronautica (Aeronautical Council) was created in 1937.

The Council has a Secretariat which is responsible for the conduct and development of Civil Aviation in the Colony, particularly the organization, establishment and exploitation of airlines and airports, the financing of civil flying schools, of aerodromes and airports and the registration of aircraft.

LOCAL TRANSPORT COMPANY

Divisão de Exploracão dos Transportes Aéreos (D.E.T.A.). Head Office: Caixa Postal No. 79, Luanda.

This is a State service which forms part of the Directorate of Harbours and Railways. It operates an extensive air network within the Colony.

FLYING CLUBS

The development of Civil Aviation began with the creation of the Aero Club de Angola, and with the organization of a private aerodrome and necessary installations near Luanda. Progress was rapid, and there now exist seven flying schools, functioning at Luanda, Benguela, Nova Lisboa, Mossamedes, Sá da Bandeira, Malange and Lobito.

AERODROMES

Benguela, Lobito, Luanda, Malange, Mossamedes, Nova Lisboa, Porto Amboim, Porto Alexandre, Santo Antonio do Zaire, Sá de Bandeira, Cabinda, Humpata, Quibala, Silva Porto, Vila Luzo and Vila Teixeira de Souza.

MOÇAMBIQUE

(Portuguese East Africa)

ADMINISTRATION

A Decree issued by the Governor-General of the Colony in 1936 created an Aeronautical Council to superintend all aviation matters in accordance with regulations then laid down. The Council had a Secretariat with functions identical to those of the Angola Secretariat.

LOCAL TRANSPORT COMPANY

Divisão de Exploracão dos Transportes Aéreos (D.E.T.A.). Head Office: Lourenço Marques. Manager: Major Pinto de Cunha.

This is a State organization forming part of the Department of Railways, Harbours and Airways.

FOREIGN TRANSPORT COMPANIES

The following companies are operating routes to and through Moçambique:—

B.O.A.C. (Great Britain).
Central African Airways (Rhodesia).

FLYING CLUBS

Aero Club de Moçambique, Lourenço Marques. President: Manuel Simões Vas. Secretary: Ramiro do Nascimento Coimbra.

Aero Club da Provincia da Zambézia, Quelimane.

Aero Club de Beira, Beira.

AERODROMES

Beira, Chibuto, Inhambane, Inhaminga, Inharrime, Lourenço Marques, Lumbo, Mocimboa da Praia, Magude, Manbone, Mima, Manhiça, Mutarara, Porto Amélia, Quelimane, Quinga, Tete, Uanetze, Vila João Belo, VilaMachado Vila Pery, Zembo, Vilanculos and Nova Lusitania.

PORTUGUESE GUINEA

(West Africa)

ADMINISTRATION

Civil Aviation in the Colony is controlled by the Serviços Aereos da Colonia (Aerial Services of the Colony). The Director of the Aerial Services is Major-Aviator Sérgio da Silva.

FLYING CLUBS

Aero Club da Guiné

This Club uses the private D.H. Leopard-Moth belonging to the Servicos Aereos da Colonia, which was flown out to the Colony from Portugal in April, 1939.

AERODROMES

Bolama. It would appear certain that this aerodrome has been considerably enlarged to take care of the numerous aircraft using it at present. No details are available.

AZORES

ADMINISTRATION

The Azores are an integral part of the Republic of Portugal.

In September, 1943 the Portuguese Government, in virtue of an ancient alliance, placed the islands at the disposal of Great Britain as a base for the protection of the Atlantic seaways. As a consequence extensive work was immediately undertaken by Britain on the extension of existing, and the building of new aerodromes.

TRANSPORT COMPANIES

Sociedade Acoriana de Estudos Aereos

This Company was formed in the Summer of 1942 with the object of linking the three principal islands, Fayal, San Miguel and Terceira. However, no operations have resulted and it is believed the Company is merely a legal necessity for Pan American Airways.

MILITARY AIR SERVICE

On October 1, 1942, the Military Authorities began a weekly public air service for passengers between Rabo de Peixe (San Miguel) and Lagens (Terceira), using Junkers Ju 52 aircraft. This service was suspended in 1943.

RUMANIA

(The Kingdom of Rumania—Rômania)

The pre-war Rumanian State Air Line (L.A.R.E.S.), which was the only Rumanian enterprise possessing the right to exploit air transport in the country, has been dissolved and all its equipment has been transferred to the new Soviet-Rumanian T.A.R.S. air transport company.

TRANSPORT COMPANY

Soc. de Transporturi Aeriene Romano-Sovietica (T.A.R.S.).

Head Office: 11, Strade Nicolae Iorga, Budapest.

This is a joint Romano-Soviet company, the capital of which is equally divided between the two Governments. The Russian contribution includes the supply of flying and airport equipment.

RUSSIA

(The Union of Soviet Socialist Republics—Soyuz Sovietskikh Sotsialistficheskikh Respublik)

ADMINISTRATION

Civil Aviation activities in the U.S.S.R. cover Air Transportation, Forestry Patrol, a Flying Medical Service, the sowing and spraying of crops, the latter including the destruction of the malarial mosquito and the locust, Flying and Gliding Schools, the instruction of the population in civil air defence, etc. For these purposes there are certain administrative bodies responsible to the Director-General of Soviet Air Transport and through him to the Council of People's Commissars.

Glavnoye Oupravlenie Grajdanskovo Vosdouchnova Flota (Chief Administration of the Civil Air Fleet), Moscow.

Chief of the Civil Air Fleet Administration and Director of Civil Aviation: V. S. Molokov.

This is the chief administrative body in the U.S.S.R. for air transportation, forestry patrol, the flying medical service, the sowing of crops and the extermination of agricultural pests.

Under the name "Aeroflot" the air transport services of the Soviet Union cover a wide network, but details of civil aviation operations are, like all other Soviet air activities, not made available other than in the form of popular propaganda as published in the Soviet press or broadcast over the Moscow radio.

The following international air services are known to be in operation:—Moscow — Paris, Moscow — Rome, Moscow — Lwow — Belgrade — Tirana, Moscow — Bucharest, Moscow — Sofia, Moscow — Budapest, Moscow — Prague, Moscow — Vienna, Moscow — Berlin and Moscow—Teheran.

Regular schedules are also maintained between Moscow and Kharbarovsk in Far Eastern Russia. Radiating from Kharbarovsk are many local services. These include routes serving Sakhalin and Kamchatka.

In the Northern Administration more than 100 services had been inaugurated. The main route connects Moscow with Leningrad. Other regular passenger and freight services link Leningrad with Volodga, Murmansk, Kalinin, Novgorod, Velikiye Luki, Archangel and Kolym.

Many types of aircraft operate the internal routes, but Russian and American-built Douglas DC-3s are mostly used for the international services.

Soviet Russia has held aloof from all attempts to interest her in international co-operation. The U.S.S.R. declined to be represented at the Chicago International Air Conference, but a seat has been reserved for its representative on the Provisional International Civil Aviation Organization established in 1945.

ASSOCIATION

Osoaviakhim (Society for Air and Chemical Defence)

This central Society, with headquarters in Moscow, unites the Osoaviakhim Societies of the Republics forming the U.S.S.R. and is responsible for the activities of the Flying and Gliding Clubs and for the instruction of the civil population in air defence, etc. It is also responsible for pre-military flying training and aerial propaganda.

The Osoaviakhim comprises a large number of Aero Clubs, most of which operate flying schools and have their own aerodromes.

PUBLICATIONS

Westnik Wosdushnowo Flota (News of the Air Fleet). The official organ of the Directorate of the Red Air Force; chiefly serves the interests of the personnel of the Military Air Fleet.

Samolet (Aircraft). Published by the Union of Osoaviakhim Societies of U.S.S.R.; deals chiefly with problems of Civil Aviation and airship navigation in U.S.S.R. and abroad, and also with aircraft models and gliders.

Chronika Wosdushnogo Dela (Chronicle of Air Business). Published by the Union of Osoaviakhim Societies; claims, on the basis of world literature to receive all news of aviation and airship navigation from abroad; reviews all important foreign articles and books referring to aviation.

Technika Wosdushnowo Flota (Air Fleet Technics). Published by a group of scientific research organizations; illuminates the problems of aircraft and engine constructions. This journal is chiefly for engineers.

CUSTOMS AIRPORTS

Europe:—Moscow, Leningrad, Velikiye Luki.

Asia:—Baku, Irkutsk, Verkue-Udinsk, Khabarovsk, Tashkent, Termez.

Civil Airports are established throughout the Union. Many aerodromes are essentially military, but are used by civil aircraft.

SALVADOR

(The Republic of El Salvador—Republica de El Salvador)

ADMINISTRATION

Civil Aviation is controlled by the Department of Aviation acting under the Chief of the Military Aviation Service.

NATIONAL TRANSPORT COMPANY

Aerovias Latino-Americanas S.A.

Head Office: 45B, Calle Ruben Dario, San Salvador.

General Manager: Don Benjamin Gonzales h.

Began operations on May 16, 1946 with three converted Douglas C-47's obtained in the United States. The airline operates from San Salvador and serves Guatemala City, Managua (Nicaragua) and St. Petersburg, Florida (U.S.A.).

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating to and through El Salvador:—

Pan American World Airways (U.S.A.).

T.A.C.A. (Honduras).

CUSTOMS AIRPORT

San Salvador (Ilopango). Altitude 2,175 ft. (664 m.). Military and Civil Customs Airport. Runways N./S. and E./W. 1,500 yds. Hangar. Beacon and night-landing facilities. Radio. D/F. and Meteorological data available.

SPAIN

(The Spanish State—España)

ADMINISTRATION

Civil Aviation is under the control of the Directorate of Civil Aviation, Magdalena 12, Madrid, which itself is under the control of the Minister for Air.

The Directorate covers all aspects of Civil Aviation, including gliding.

ASSOCIATIONS

Federación Aeronáutica Nacional de España (F.A.N.E.), Calle Mayor 4, Madrid.

This body is the representative of the *Fédération Aéronautique Internationale* (F.A.I.). President: Don Alfonso de Hoyos

SPAIN—*continued.*

Sánchez, Viscount Manzanera. Secretary: Don José Barcala Moreno.

The Aero Clubs of Madrid, Seville, Valencia, Barcelona and Zaragoza are affiliated to the F.A.N.E.

PUBLICATION

Revista de Aeronautica. The official organ of the Air Ministry. Editor: Teniente Coronel Francisco Iglesias. Foreign Editor: Teniente Coronel Ricardo Munaiz. Address: Juan de Mena 8, Madrid. Issued monthly. Price 5.00 ptas.

TRANSPORT COMPANIES

Lineas Areas Espanolas "Iberia". Head Office: Plaza de Canovas del Castillo 4, Madrid. President: Jesus Rubio Paz. Manager: Cesar Gomez Lucia. Chief Pilot: Jose Ansaldo Vejarano.

This company holds exclusive rights for the operation of national and international Spanish airlines.

Compania Auxiliar de Navegacion Aerea S.A. Head Office: Madrid. President: Duke of Parma. Managing Director: Don Ultano Kindeland y Nunez del Pino.

This company has a capital of 2,500,000 Pesetas and intends to operate non-scheduled services with British flying equipment.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Spain:—

A.B. Aerotransport (Sweden).
British European Airways Corpn. (Great Britain).
K.L.M. (Netherlands).
S.A.B.E.N.A. (Belgium).
Swissair (Switzerland).
T.W.A. (U.S.A.).

AIRPORTS

Barajas (Madrid). Lat. 40°28′N., Long. 3°36′W. Province of Madrid. 9 miles N.E. of city. Alt. 2,000 ft. Runway N.E.-S.W. 1,673 yds. × 55 yds. Full facilities.

San Pablo (Seville). Lat. 37°25′N., Long. 5°55′W. Province of Seville. 4½ miles E.N.E. of city. Alt. 65 ft. Runway N.E.-S.W. 1,140 yds. × 55 yds. Full facilities.

Menises (Valencia). Lat. 39°30′N., Long. 0°29′W. Province of Valencia. 5 miles W. of city. Alt. 49 ft.

Muntadas (Barcelona). Lat. 41°18′N., Long. 2°03′E. Province of Barcelona. 9 miles S.W. of city. Alt. 13 ft. W/T. and D/F.

Barcelona (Seaplane Stn.). Lat. 41°22′N., Long. 2°10′E. S.E. side of city.

Son Bonet (Mallorca Isd.). Lat. 39°35′N., Long. 2°48′E. Province of Baleares. 6 miles N.E. of Palma. Alt. 55 ft.

Pollensa (Seaplane Stn.). Lat. 39°54′N., Long. 3°04′E. Province of Baleares. Close to Pollensa city.

Gando (Las Palmas). Lat. 27°55′N., Long. 15°21′W. 12½ miles S. of Las Palmas in Gando Bay. Two runways. Full facilities.

SWEDEN

(The Kingdom of Sweden—Sverige)

ADMINISTRATION

Civil Aviation is under the jurisdiction of the Kungl. Luftfartsstyrelsen, (The Royal Board of Civil Aviation) Hantverkaregatan 21, Stockholm. Director-General C. Ljungberg.

ASSOCIATIONS

Kungl. Svenska Aeroklubben (Royal Swedish Aero Club). Founded 1900. Offices: Malmskillnadsgatan 27, Stockholm. Secretary: Colonel H. Enell.

The Club, which is affiliated to *Fédération Aéronautique Internationale*, is the principle organization and the controlling body for 53 Swedish Aero-clubs. It is the governing body of the sport of flying in Sweden.

Svenska Flygares Riksförbund (National Guild of Swedish Pilots). 6, Fredsgatan, Stockholm. Chairman: Carl Trygger. Vice-Chairman: Colonel K. J. A. Silfverberg (S.R.A.F.). General Secretary: Captain G. M. M. Lilliehöök.

The aims of the Guild are to serve Swedish aviation and represent the interests of Swedish pilots by promoting the development of aviation and making the Swedish people air-minded.

Eligible are holders or former holders of civil pilot's licence, civilian navigators and wireless-operators, pilots, observers, wireless-operators and air-gunners of the Swedish Air Force.

TECHNICAL INSTITUTIONS

Flygtekniska Försöksanstalten (Institution of Aerotechnical Researches). Ranhammarsvägen 12-14, Ulvsunda. Director: I. Malmer.

Kungl. Tekniska Högskolan (The Royal Technical University). Valhallavägen 78, Stockholm.

PUBLICATIONS

Flyg. Published fortnightly at Tegnérgatan 35, Stockholm. On October 1, 1942, *Flygning*, which was originally the official journal of the Royal Swedish Aero Club, was merged with the Swedish Air Force publication *Flygpost.* Until January 1, 1943, the joint publication bore both names. Now renamed *Flyg.* On January 1, 1946, the journal *Svensk Flygtidning* was incorporated. Managing Editor: Col. W. Kleen. Circulation 40,000 copies.

Vingar. Published monthly at Roslagsgatan 62, Stockholm. Managing Editor: B. Lingmark.

Aero. Published monthly at Tunnelgatan 15, Stockholm. Managing Editor: U. Hallvig.

Nordisk Flygtidning. Published monthly at Malmö. Managing Editor: A. M. Lundgren.

NATIONAL TRANSPORT COMPANIES

Aktiebolaget Aerotransport (Swedish Air Lines, A.B.A.).
Address: Kungsholmstorg 1, Stockholm.
Chairman: Frans Severin.
Managing-Director: Captain C. Florman.

A.B. Aerotransport (Swedish Air Lines) was founded in 1924. The company was privately-owned during its first five years. Thereafter the Government then took over progressively larger blocks of the shares and it now possesses more than 90 per cent of the capital. Until 1945, A.B.A. received government subsidies but the company has now increased its traffic to such extent that government subsidies are no longer required.

Svensk Interkontinental Lufttrafik A.B. (S.I.L.A.).
Address: Stockholm.
Chairman: Thorsten Hèrnod.
Managing-Director: P. A. Norlin.

This Company was formed to permit Sweden to take ull advantage of post-war intercontinental air transport.

It was formed on February 25, 1943, and at the founders' meeting on May 31, representatives of 77 leading Swedish industrial and commercial firms subscribed the fully paid-up capital of Kr. 12,000,000. In the beginning of 1946, this capital was increased to Kr. 24,000,000, also fully paid-up. Participation by the Government has purposely been avoided.

Beginning its operations in the Summer of 1945, S.I.L.A. first made a series of survey flights between Stockholm and New York, Stockholm and Addis Ababa and Stockholm and Rio de Janeiro. Most of these flights were made with converted Boeing B-17 Fortress four-engined aircraft. In the Summer of 1946, S.I.L.A. opened its regular services on the same routes, mainly with Douglas DC-4-1009 airliners, which, eventually are to be replaced by Boeing Stratocruisers, four of which are to be put into service during 1947.

No Government subsidy has been asked for. A close liaison is maintained with A.B.A., which has placed its Administration, Commercial Organization and technical services at the disposal of the company.

Svenska Aero-Lloyd A.B.
Address: Göteborg.

The Company has been formed as a subsidiary of the shipping company, Svenska Lloyd. The Managing-Director of the Company, K. R. Bökman, is also Managing-Director of the shipping company, and a member of the Board of Directors of the newly-formed S.I.L.A.

Skandinaviska Aero A.B. (Scandinavian Airways, Ltd.).
Address: Stockholm.
Chairman: K. R. Bökman (Managing Director of Rederi A. B. Svenska Lloyd). Managing Director: M. Hoogland.

The company was formed to take over the taxi and charter flying business formerly operated under the name of A.B. Björkvallsflyg. During the war the company was mainly occupied with target-towing and other semi-military duties.

In November, 1944, the control of the company was taken over by several shipping owners in Gothenburg, a considerable enlargement of the company's capital at the same time being announced.

During 1946, the company started non-scheduled flying to the Continent carrying cargo and passengers.

Svensk Flygtjänst A.B.
Address: Arsenalsgatan 4, Stockholm.
Managing Director: Tor Eliasson.

This company has existed for some years and has, until recently, been chiefly occupied with school and taxi flying. It plans to operate feeder lines in connection with A.B.A.'s International lines.

Norrlandsflyg A.B.
Address: Luleå.
Director: F. Burström.

Aero Service A.B.
Address: Grevturegatan 3, Stockholm.
Director: G. af Ekenstam.

CUSTOMS AIRPORTS

Stockholm-Bromma. Lat 59° 21′N., Long. 17°58′E. 8 km. W.N.W. of city. Runways 2,000 × 60 m., N.W./S.E. 950

SWEDEN—*continued.*

× 40 m. W./E., 1,000 × 40 m. S.W./N.E., 750 × 40 m. N.N.W./S.S.E. Hangars. Full repairs. Full night facilities. W/T., D/F. Lorenz. Customs.

GÖTEBORG-TORSLANDA. Lat. 57°42′N., Long. 11°47′E. 11 km. W. of town. Runways 1,850 × 60 m. N.E./S.W., 1,150 × 40 m. E./W., 1,100 × 40 m. N.W./S.E. Hangar. Minor repairs. Full night facilities. W/T., D/F., Lorenz. Customs.

MALMÖ-BULLTOFTA. Lat. 55°36′N., Long. 13°04′E. 3.5 km. E. of town. Runways 1,200 m. N.W./S.E., 1,100 m. N.E./S.W. Hangars. Full repairs. Full night facilities. W/T., D/F., Lorenz. Customs.

VISBY. Lat 57°39′N., Long. 18°20′E. 2 km. N.E. of town. Runways 1,350 m. N.E./S.W., 1,000 m. E./W. Hangar 37 × 26 m. Minor repairs. Minor night facilities. W/T., D/F. Customs.

KARLSTAD. Lat. 59°21′N., Long. 13°28′E. 2 km. S. of town. Runways 1,000 m. N./S., 1,000 m. N.E./S.W. No hangar. Minor repairs. D/F. Customs.

NORRKÖPING-KUNGSÄNGEN. Lat. 58°35′N., Long. 16°14′E. 2 km. E. of town. Runway 1,750 m. × 60 m. E./W., landing strip 700 m. N./S. Hangar 21 × 15 m. Minor repairs. Minor night facilities. W/T., D/F. Customs.

JÖNKÖPING. Lat. 57°36′N., Long. 14°11′E. 2 km. S. of town. Runways 750 m. E./W., 650 m. N./S. Hangar 20 × 18 m. Minor night facilities. W/T., D/F. Customs.

CUSTOMS SEAPLANE STATIONS

STOCKHOLM-LINDARÄNGEN. Lat. 59°21′N., Long. 18°08′E. 3.5 km. N.E. of city. Alighting area 1,500 × 1,500 × 2,000 m. Hangars. Minor repairs. No night facilities. Customs.

GÖTEBORG-TORSLANDA. Lat. 57°42′N., Long. 11°47′E. 11 km. W. of town. Alighting area 1,000 × 1,000 × 1,000 m. Hangars. No night facilities. W/T., D/F. Customs.

SWITZERLAND

(The Swiss Confederation—Schweizerische Eidgenossenschaft)

ADMINISTRATION

Civil Aviation is controlled by the Department of Civil Aviation headed by a Delegate for Civil Aviation. This department is part of the Department des Postes et des Chemins de Fer. The Chief of the Office Aérien Fédéral is Colonel Louis Clerc.

ASSOCIATIONS

Aero Club der Schweiz (Aéro-Club de Suisse). President: Lt.-Col. W. N. Gerber, Sihlquai 55, Zürich. Secretary General: Capt. Rieser, Schanzenstrasse 1, Berne.

The Swiss Aero Club has 22 Sections to which the following groups were attached:—15 power-driven flying groups; 2 free balloon groups; 51 gliding groups; and 26 groups for the construction of models.

PUBLICATIONS

Aéro Revue (Official Organ of L'Aéro Club de Suisse). Büchler & Co., Berne, 8. Fortnightly.

Interavia. Aeronautical news from all parts of the globe. Soc. Anon. d'Edition Aéron. Internationales, Cité 20, Geneva, 11. Twice weekly.

NATIONAL TRANSPORT COMPANIES

Alpar A.G.

Head Office: Jubilaeumsstrasse, Bern. President of the Board: Paul Cardinaux. Vice-President: Hermann Wanner.

This company which was inoperative during most of the war is now functioning again and is increasing its capital from 250,000 Sw. Francs to 1,200,000 Sw. Francs. In 1947, Alpar was being merged into Swissair.

Swissair.

Head Office: Bahnhofstrasse 7, Zurich. Chairman: Doctor Alphous Ehinger. President: Eugen E. Groh.

Swissair was not operating at the end of the war, although it had managed to maintain its Zurich-Stuttgart service until August, 1944. Since it re-started operations in May, 1945, a rapid expansion of services has been carried out. Capital is being increased from 1,000,000 Swiss Francs to 20,000,000 Swiss Francs.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating regular services to and through Switzerland:—

A.B. Aerotransport (Sweden).
Air France (France).
British European Airways Corpn. (Great Britain).
C.S.A. (Czechoslovakia).
K.L.M. (Netherlands).
S.A.B.E.N.A. (Belgium).
Trans-World Airline (U.S.A.).

FLYING SCHOOLS

Swissair. Aerodrome: Zürich-Dubendorf.
Alpar. Aerodrome: Berne-Belpmoos.
Ostschweiz. Aero-Gesellschaft. Aerodrome: Altenrhein - St. Gallen.
Aviatik beider Basle. Aerodrome: Basle-Birsfelden.

Sections of the **Aero Club de Suisse** at:—Basle, Bellinzona, Berne, La Chaux-de-Fonds, Geneva, Grenchen, Lausanne, Neuchâtel, Sion, St. Gall, Thun, Zürich, Locarno.

AERODROMES

Various plans for new airports in Switzerland have been reported in connection with post-war flying. There is to be a combined land-marine base at LAUSANNE-ECUBLENS on the shore of Lake Geneva at St. Sulpice. The estimated cost is Sw. fr. 7,000,000. Expansion of the airport at COINTRIN is already being proceeded with. The municipality of Berne is sponsoring the construction of a large airport at UTZENSTORF which is intended to be the central Swiss airport for international services.

1st Class Customs Airports

GENEVA (Cointrin). Lat. 46°14′N., Long. 06°05′E. Altitude 1,394 ft. Runway N.E./S.W. 2,186 yds. × 55 yds. Concrete taxiways.

ZURICH (Dübendorf). Lat. 47°24′N., Long. 08°38′E. Altitude 1,444 ft. Landing area 1,150 × 1,100 m. with turfed runway. Concrete runway 500 × 21 m. Asphalt runway 600 × 40 m.

BASLE (Birsfelden). Lat. 47°33′N., Long. 07°38′E. Altitude. 869 ft. Two turfed runways W. E. and N.W./S.E.

BASLE-MULHOUSE. International Franco-Swiss airport on French soil, but with international road to Swiss territory. Metal runway 1,200 × 40 m. French customs on airport, Swiss customs at Franco-Swiss border.

2nd Class Customs Airports

BERNE (Belpmoos). Lat. 46°54′N., Long. 07°30′E. Altitude 1,672 ft. No runways.

LAUSANNE (La Blécherette). Lat. 46°32′N., Long. 06°37′E. Altitude 2,024 ft. No runways.

ALTENRHEIN (St. Gallen). Lat. 47°27′N., Long. 09°33′E. Altitude 1,312 ft. No runways.

3rd Class Customs Airports

LOCARNO (Magadino). Lat. 46°10′N., Long. 08°53′E. Altitude 200 m. No runways.

LA CHAUX-DE-FONDS (La Eplatunes). Lat. 47°05′N., Long. 06°48′E. Altitude 3,346 ft. No runways.

Customs Seaplane Stations:—GENEVA (Eaux-Vives), LAUSANNE (Onchy), LOCARNO, LUGANO, RORSCHACH, ROMANSHORN, ERMATINGEN, KREUZLINGEN, ARBON, ALTENRHEIN (St. Gallen).

Aerodromes for Internal Traffic:—BIENNE, SION, SAMADEN.

Aerodromes available only by special permission:—BELLINZONA, HILFIKON, GLAND, GRENCHEN, PORRENTRUY (Courtedoux), YVERDON.

Winter Aerodrome:—ST. MORITZ (on frozen lake by special permission only).

TRANSJORDAN

TRANSPORT COMPANY

Arab Airways Association, Ltd. Head Office: Amman. Chairman: Wafa Dajani. Director and Organizing Manager: R. T. Ledger, M.B.E. Technical Manager: W. G. Saunders.

This company has an authorised capital of £100,000 with approximately £98,000 covered privately. The Directors consist of leading Arabs in the commercial world in Palestine and Transjordan. The company is financially interested in Eastern Airways, Ltd., of Palestine. All pilots will be British initially.

TURKEY

(The Turkish Republic—Türkiye Cumhuriyeti)

ADMINISTRATION

Civil Aviation in Turkey is under the control of the Ministry of Communications, but the Military General Staff lay down the routes on which aircraft may fly.

ASSOCIATIONS

Türk Hava Kurumu (Air League). A semi-official organization designed to promote and foster the growth of "air-mindedness" in Turkey. It has a considerable income, derived from a tax on all salaries and wages, and from lotteries, subscriptions, and donations. The League runs the only authorized lottery in Turkey.

Türkkusu ("Turkish Bird") Association. An offshoot of the Air League. It was inaugurated at Ankara on May 3, 1935, and has since opened branches in the chief provincial towns. Its object is the building up of a reserve of pilots and mechanics for the Government Air Force. Initial training is carried out on gliders and advanced training on powered aircraft.

TURKEY—*continued.*

NATIONAL TRANSPORT COMPANY

Devlet Hava Yollari (Turkish State Air Lines). Head Office: Ankara. Director General: Ferruh Sahinbas. Director of Operations: Naci Ustman. Chief Pilot: Hayri Oscal.

Operated by the department of the Ministry of Communications.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Turkey:—

A.B. Aerotransport (Sweden).
Air France (France).
British European Airways Corpn. (Great Britain).
British Overseas Airways Corpn. (Great Britain).

AIRPORTS

ADANA. Lat. 36°58′N. Long. 35°17′E. 1 mile W. of town. Two runways N./S. and N.E./S.W. 40 m. × 1,500 m. Hangars. Minor repairs. Military and Civil Customs Aerodrome.

ANKARA. Lat. 39°57′N. Long. 32°52′E. 4 miles W. of town. Alt. 3.000 ft. Three runways 40 m. × 1,200 m. (N.E./S.W.), 40 m. × 1,200 m. (E./W.) and 40 m. × 900 m. (N./S.). Administration building and hangars. W/T.

YESILKÖY (Istanbul). Lat. 40°58′N. Long. 28°50′E. 5 miles S.W. of town. Alt. 50 ft. Three runways 40 m. × 1,200 m. (N.E./S.W., E./W. and N./S.). Administration building and hangars. Full night-landing facilities. Military and Civil Customs Aerodrome.

KONYA. Lat. 37°58′N. Long. 32°34′E. 3 miles E. of town. Alt. 3,500 ft. One runway 40 m. × 2,600 m. (N.N.E./S.S.W.). No facilities.

AFYONKARAHISSAR. Lat. 38°44′N. Long. 30°36′E. Two runways 40 m. × 1,832 m. (N.W./S.E.) and 46 m. × 1,570 m. (N.N.W./S.S.E.). Administrative buildings only. No facilities.

THE UNITED STATES OF AMERICA

ADMINISTRATION

The control of Civil Aviation in the United States is vested in the Civil Aeronautics Administration. The Administrator of Civil Aeronautics acts under the direction and supervision of the Secretary of Commerce. The Civil Aeronautics Board exercises its functions of rule making, adjudication and investigation independently of the Secretary of Commerce.

THE DEPARTMENT OF COMMERCE, Commerce Building, Washington 25, D.C.
Secretary of Commerce: Averill Harriman.
Assistant Secretary of Commerce: William A. M. Burden.

Civil Aeronautics Administration
Administrator: Theodore P. Wright.
Deputy Administrator: Charles I. Stanton.
General Counsel, Aeronautical Legal Staff: Richard E. Elwell.
Executive Assistant: Edward Sturhahn.
Assistant for Personal Flying Development: John Geisse.
Assistant for Research: Dean R. Brimhall.
Assistant for State Relations: E. J. Robins.
Assistant Administrator for Airports: C. B. Donaldson.
Assistant Administrator of Aviation Information: Ben Stern.
Assistant Administrator for Business Management: Alvin O. Preil.
Assistant Administrator for Federal Airways: William E. Kline.
Assistant Administrator for Field Operations: A. S. Koch.
Assistant Administrator for Safety Regulation: Fred M. Lanter.

Civil Aeronautics Board
Chairman: James M. Landis.
Vice-Chairman: Oswald Ryan.
Members: Harllee Branch, Josh Lee, Clarence M. Young.
Secretary: Fred A. Toombs.
General Counsel: Emory T. Nunneley, Jr.
Director, Economic Bureau: Russel B. Adams.
Assistant Director (Domestic): Robert W. Oliver.
Assistant Director (International): John Sherman.
Director, Safety Bureau: Joseph B. Duckworth.

Government Research and Technical Establishment, 1500, New Hampshire Avenue, N.W., Washington 25, D.C.

An independent Government establishment created by an Act of Congress approved on March 3, 1915, for the supervision and direction of the scientific study of the problems of flight. It consists of fifteen members, appointed by the President, all of whom serve as such without remuneration.

The officials of the Committee are:—
Chairman: Jerome C. Hunsaker, Sc.D.
Vice-Chairman: Theodore P. Wright.
Executive Secretary: John F. Victory.
Executive Officer: Edward H. Chamberlin.
Director of Aeronautical Research: George W. Lewis, Sc.D.
Engineer in Charge, Langeley Memorial Aeronautical Laboratory: Henry J. E. Reid.
Engineer in Charge, Ames Aeronautical Laboratory: Smith J. DeFrance.
Manager, Aircraft Engine Research Laboratory: Edward R. Sharp.
Executive Engineer, Aircraft Engine Research Laboratory: Carlton Kemper.

ASSOCIATIONS

Aero Medical Association. C/o. Dr. D. S. Brachman, 5440 Cass Avenue, Detroit 2, Michigan.

Aeronautical Radio, Inc. 1108, 16th Street, N.W., Washington 6, D.C.

Air Force Association. 1603, K Street, N.W., Washington, D.C.

The Air Power League. Empire State Building, New York 1, N.Y.

Aircraft Industries Association of America, Inc. 610, Shoreham Buildings, Washington 5, D.C.

Aircraft Owners & Pilots Association. 1319, F Street, N.W. Washington 4, D.C.

Airline Navigators Association. P.O. Box 276, Falls Church, Virginia.

Air Line Pilots Association, International. 3145 West 63rd Street, Chicago 29, Ill.

Air Traffic Conference of America. 1515, Massachusetts Avenue, N.W., Washington, D.C.

Air Transport Association of America. 1515, Massachusetts Avenue, N.W., Washington 5, D.C.

Air Youth (National Aeronautic Association). 1025, Connecticut Avenue, N.W., Washington 6, D.C.

American Association of Airport Executives. C/o. Pat Moore, Secretary Treasurer, P.O. Box 734, Peoria, Ill.

The American Helicopter Society, Inc. New field P.O. Box 4029, Bridgeport, Conn.

American Municipal Association. 1313, East 60th Street, Chicago 37, Ill.

American Rocket Society, Inc. 29, West 39th Street, New York 18, N.Y.

The American Society of Mechanical Engineers, Aviation Division. 29, West 39th Street, New York.

Aviation Country Club of California, Inc. 6656, Santa Monica Blvd., Los Angeles, California.

Aviation Writers Association. P.O. Box 856, Grand Central Annex, New York 17, N.Y.

The Brookings Institution. 722, Jackson Place, N.W., Washington 6, D.C.

California Manufacturers Association. 520, Chamber of Commerce Buildings, Los Angeles 15, Cal.

Caterpillar Club. P.O. Box 1328, Trenton, N.J.

Council of State Governments. 1313 East 60th Street, Chicago 37, Ill.

The Early Birds. C/o. Lt.-Col. Ernest Jones, Secretary, R.F.D., No. 1, Clifton, Va.

Feeder Airlines Association. 1113, Denrike Building, Washington, D.C.

The Glider Institute of the Americas, Inc. 1026, 17th Street, N.W., Washington 6, D.C.

Institute of the Aeronautical Sciences. 2, East 64th Street, New York 21, N.Y.

Institute of Navigation. 405, Hilgard Avenue, Los Angeles 24, Cal.

Manufacturers Aircraft Association, Inc. 30, Rockefeller Plaza, Suite 726, New York 20, N.Y.

National Aeronautic Association. 1025, Connecticut Avenue, N.W., Washington 6, D.C.

National Association of Flying Clubs. 821 National Press Building, Washington, D.C.

National Association of State Aviation Officials. C/o. Edw. F. Knapp, Dir. Vermont Aeronautics Commission, State House Montpelier, Vermont.

National Aviation Trades Association. Temporary Headquarters: 1113, Denrike Building, 1010, Vermont Avenue, Washington, D.C.

National Council of Air Line Navigators. 545, 5th Avenue, New York, N.Y.

National Safety Council. 20, North Wacker Drive, Chicago 6, Illinois.

Aviation Section, New York Board of Trade, Inc. 291, Broadway, New York 7, N.Y.

New York State Aviation Council, Inc. Municipal Airport, Syracuse, N.Y.

Northwest Aviation Planning Council. C/o. W. S. Thompson, Manager, Chamber of Commerce, Butte, Montana.

Private Fliers Association. C/o. Wm. W. Grinckerhoff, 1706 G Street, N.W., Washington, D.C.

Relief Wings, Inc. 247, Park Avenue, New York 17, N.Y.

The Soaring Society of America. Elmira, New York.

Society of Aeronautical Weight Engineers. 143 North Brand Boulevard, Glendale 3, Calif.

Sportsman Pilots Association. C/o. C. H. Warrington, 327, North Bell Avenue, Chicago 12, Ill.

UNITED STATES—*continued.*

The Wings Club, Inc. Hotel Biltmore, New York, N.Y.

Women Flyers of America, Inc. 274, Madison Avenue, New York, N.Y.

PUBLICATIONS

Aero Digest, published by the Aeronautical Digest Publishing Corpn., 515, Madison Avenue, New York 22, N.Y. Publisher: Frank A. Tichenor. (Monthly).

Aeronautical Engineering Catalog, published by the Institute of the Aeronautical Sciences, 2, East 64th Street, New York 21, N.Y. Annual.

Aeronautical Engineering Review, published by the Institute of the Aeronautical Sciences, 2, East 64th Street, New York 21, N.Y. Editor: George R. Forman. (Monthly).

Aerosphere, published by the Aerosphere, Inc., 370, Lexington Avenue, New York 17, N.Y. Editor: Charles E. Thorp—Executive Editor. (Annual).

Air Facts, published by the Air Facts, Inc., 30, Rockefeller Plaza, New York 20, N.Y. Editor: Leighton Collins. (Monthly).

The Air Line Mechanic, published at 155 North Clark Street, Chicago 1, Ill. Editor: J. L. McFarland. (Monthly).

The Air Line Pilot, published by the Air Line Pilots Association, 3145 West 63rd Street, Chicago 29, Ill. Editor: David L. Behncke. (Monthly).

Air Force, published by the Phillip Andrews Publishing Co., 545 5th Avenue, New York 17, N.Y. Editor: Phillip Andrews. (Monthly).

Air Traffic Guide, published by the American Aviation Publications, 139 North Clark Street, Chicago 2, Ill. Managing Editor: H. D. Whitney. (Airline rates and schedules revised monthly).

Air Trails Pictorial, published by the Street & Smith Publications, 122 East 42nd Street, New York 17, N.Y. Editor: William Winter. (Monthly).

Air Transport, published by the McGraw-Hill Publishing Co., 330, West 42nd Street, New York 18, N.Y. Editor: Fowler Barker. (Monthly).

Air Transport Safety, published by the National Safety Council, 20, North Wacker Drive, Chicago 6, Ill. (Monthly).

Air Transportation, published by Import Publications, Inc., 10, Bridge Street, New York 4, N.Y. Publisher: John F. Budd. (Monthly).

Air World, published by the Columbia Publications, Inc., 40, Worth Street, New York, N.Y. Editor: S. C. Frazier. (Monthly).

Aircraft Engines of the World, published at 216 East 45th Street, New York 17, N.Y. Editor: Paul H. Wilkinson. (Annual).

Aircraft Production, published at 1206, South Maple Avenue, Los Angeles 15, Calif.

Aircraft Yearbook, (Aircraft Industries Association of America), published by the Lanciar Publishers, Inc., 10, Rockefeller Plaza, New York 20, N.Y. Editor: Howard Mingos. (Annual).

Airport Directory, published by the Publishing Co., 1170, Broadway, New York 1, N.Y. Editor: Kirk Baldwin. (Annual).

Airports, published by the Haire Publishing Co., 1170, Broadway, New York 1, N.Y. Editor: John Regan. (Monthly).

American Aviation Publications, published by the American Aviation Associates, Inc., 1317, F. Street, N.W., Washington 4, D.C. Executive Editor: Albert H. Stackpole.

American Aviation, published by the American Aviation Associates, Inc., American Building, Washington 4, D.C. Editor: Kenneth E. Allen, Managing Editor: Kenneth E. Allen. (Semi-Monthly).

American Aviation Daily, published by the American Aviation Associates, Inc., American Building, Washington 4, D.C. Managing Editor: Clifford Guest. (Daily).

American Aviation Directory, published by the American Aviation Associates, Inc., American Building, Washington 4, D.C. Managing Editor: David Shawe. (Semi-Annual).

American Helicopter, published at 32, East 57th Street, New York 22, N.Y. Editor: Alexis Droutzkoy.

Aviation, published by the McGraw-Hill Publishing Co., 330, West 42nd Street, New York 18, N.Y. Editor: Leslie E. Neville. (Monthly).

Aviation Equipment, published by the Haire Publishing Co., 1170, Broadway, New York 1, N.Y. Editor: John Regan. (Monthly).

Aviation Law Service, published by the Commerce Clearing House, Inc., 214, North Michigan Avenue, Chicago 1, Ill. (Weekly).

Aviation Maintenance and Operations, published by the Conover-Mast Corpn, 205, East 42nd Street, New York 17, N.Y. Managing Editor: Arthur W. D. Harris. (Monthly).

Aviation News, published by the McGraw-Hill Publishing Co., National Press Buildings, Washington, D.C. Editor: Robert H. Wood. (Weekly).

Aviation Service Magazine, published at 540, West Washington Boulevard, Chicago 6, Ill. Editor: Herb Packer. (Monthly).

Civil Aeronautics Journal, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. (Monthly).

Flying, published by the Ziff-Davis Publishing Co., 185, North Wabash Avenue, Chicago 1, Ill. Managing Editor: Max Karant. (Monthly).

Flying Ace (Including *Flying Aces*), published at 67 West 44th Street, New York 18, N.Y. Editor: Roel I. Wolfson. (Monthly).

Foreign Air News Digest, published by the Economic Bureau, Civil Aeronautics Board, Washington 25, D.C. (Bi-Monthly).

Gliding, published by the Gliding Magazine, 4658, Portage Road, Kalamazoo 85, Mich. Editor: Ward A. Stone. (Monthly).

International Aviation, published by the American Aviation Associates, Inc., American Building, Washington, D.C. Managing Editor: Frank M. Holz. (Weekly).

Journal of Aeronautical Meteorology, Meteorological Committee, Air Transport Association of America. Editor: E. J. Minser, 10, Richards Road, Kansas City, Mo. (Quarterly).

Journal of the Aeronautical Sciences, published by the Institute of the Aeronautical Sciences, 2, East 64th Street, New York 21, N.Y. (Quarterly).

Journal of the American Rocket Society, published by the Rocket Society, Inc., 130, West 42nd Street, New York 18, N.Y. Editor: Cedric Giles.

Journal of Aviation Medicine, published by the Aero Medical Association of the U.S., 2642, University Avenue, St. Paul, Minn. Editor-in-Chief: Louis H. Bauer, M.D. (Bi-Monthly).

Model Airplane News, published by the Air Age Inc., 551, 5th Avenue, New York 17, N.Y. Editor: Robert McLarren. (Monthly).

Model Aviation, published by the Air Youth Div., National Aeronautic Association, 1025, Connecticut Avenue, Washington 6, D.C. (Monthly).

National Aeronautics, published by the National Aeronautic Association, 1025, Connecticut Avenue, Washington 6, D.C. Editor: S. Ralph Cohen. (Monthly).

Official Guide of the Airways, published at 608, South Dearborn Street, Chicago 5, Ill. (Monthly).

S.A.E. Journal, published at 29, West 39th Street, New York 18, N.Y. Executive Editor: Norman G. Shidle. (Monthly).

Skyways, published by the Henry Publishing Co., 444, Madison Avenue, New York 22, N.Y. Editor: J. Fred Henry. (Monthly).

Soaring, published by the Soaring Society of America, P.O. Box 71, Elmira, N.Y. (Bi-Monthly).

Southern Flight, published by the Air Review Publishing Corpn., 1901, McKinney Avenue, Dallas 1, Texas. Editor: George E. Haddaway. (Monthly).

Thermal, published by the Southern California Soaring Association, 453, South Spring Street, Los Angeles 13, Cal.

U.S. Air Services, published by the Air Service Publishing Co., Inc., Transportation Building, Washington 6, D.C. Editor: Earl N. Findley. (Monthly).

Western Airman, published at the Ellis-Building, Phoenix, Ariz. (Semi-Monthly).

Western Flying, published by the Occidental Publishing Co., Ltd., 304, South Broadway, Los Angeles 13, Calif. Editor: Lawrence Black. (Monthly).

TRANSPORT COMPANIES

All American Aviation, Inc., 210, Greenhill Avenue, Wilmington 99, Deleware. President: Robert M. Love.

This company operates Air Mail Route AM-49 exploiting the "air pick-up" system for mail and express.

American Airlines, Inc. (American Airlines System), 100, East 42nd Street, New York 17, N.Y. President: Ralph S. Damon.

In July, 1945, American Airlines was authorized to acquire 51.4 per cent stock interest in American Export Airlines, now titled American Airlines Overseas, Inc. The name American Airlines System has been used in advertising the routes of the two companies.

American Overseas Airlines, Inc. (formerly American Export Airlines), 100 East 42nd Street, New York 17, N.Y. President: C. R. Smith.

Braniff International Airways, Inc., Love Field, Dallas 9, Texas. President: T. E. Braniff.

On May 17, 1946, Braniff Airways was granted a route to Latin America. In conformity with this new service, the company has adopted the new trade name of Braniff International Airways.

Caribbean-Atlantic Airlines, Inc., 47, Recinto Sur Street, San Juan, Porto Rico. President: Dionisio Trigo.

Chicago and Southern Air Lines, Inc., Municipal Airport, Memphis 2, Tenn. President: Carleton Putman.

Colonial Airlines, Inc., 630, 5th Avenue, New York 20, N.Y. President: Sigmund Janas.

Continental Air Lines, Inc., Stapleton Airfield, Denver 7, Colo President: Robert F. Six.

Delta Air Lines, Inc. (formerly Delta Air Corporation), Municipal Airport, Atlanta, Georgia. President and General Manager: C. E. Woolman.

Eastern Air Lines, Inc., 10, Rockefeller Plaza, New York 20, N.Y. President: E. V. Rickenbacker.

Empire Air Lines, Inc. (formerly Zimmerly Airlines, Inc.), Lewiston, Idaho. President: Bert Zimmerly.

This carrier was granted a temporary certificate by the Civil Aeronautics Board on May 22, 1946.

UNITED STATES—*continued.*

Florida Airways, Inc. (formerly Orlando Airlines, Inc.), Cannon-Mills Airport, Orlando, Fla. President: Thomas E. Gordon.
This carrier was granted a temporary certificate by the Civil Aeronautics Board on March 28, 1946.

Inland Air Lines, Inc., 6331, Hollywood Boulevard, Los Angeles 28, California. President: William A. Coulter.

Mid-Continent Airlines, Inc., 102 East 9th Street, Kansas City 6, Mo. President: J. W. Miller.

National Airlines, Inc., Municipal Airport, Jacksonville, Fla. President: G. T. Baker.

Northeast Airlines, Inc., Commonwealth Airport, Boston 28, Mass. President: Paul F. Collins.

Northwest Airlines, Inc., 1885, University Avenue, St. Paul 1, Minn. President and General Manager: Croil Hunter.

Pan American Airways System (Pan American World Airways), 135, East 42nd Street, New York 17, N.Y. President: Juan T. Trippe.
Pan American Airways is divided into the following operating divisions:—
PACIFIC—ALASKA DIVISION.
LATIN AMERICAN DIVISION.
ATLANTIC DIVISION.
AFRICA—ORIENT DIVISION.
The following companies are, or have been, subsidiaries of Pan American Airways:—
AEROVIAS NATIONALES DE COLOMBIA, S.A. (COLOMBIA).
URABA, MEDELLIN AND CENTRAL AIRWAYS, INC.
CIA. MEXICANA DE AVIACION, S.A. (MEXICO).
CIA. CUBANA DE AVIACION, S.A. (CUBA).
PANAIR DO BRASIL, S.A. (BRAZIL).
The following companies are, or have been, associated with Pan American Airways:—
PAN AMERICAN-GRACE AIRWAYS, INC.
CHINA NATIONAL AVIATION CORPORATION (CHINA).
AEROVIAS DE GUATEMALA, S.A. (GUATEMALA).
AERONAVES DE MEXICO, S.A. (MEXICO).
For details of the activities of the foreign companies controlled by or subsidiary to Pan American Airways, see under the countries concerned.

Pan American-Grace Airways, Inc. (Panagra), 135, East 42nd Street, New York 17, N.Y. President: Harold J. Roig.

Pennsylvania-Central Airlines Corporation, Washington National Airport, Washington 25, D.C. President: C. Bedell Monro.

Pioneer Air Lines, Inc. (formerly Essair, Inc.), 3300, Love Field Drive, Dallas 9, Texas. President: Robert J. Smith.

Southwest Airways Company, P.O. Box 270, Beverly Hills, Calif. President: John H. Connelly.
This carrier was granted a temporary certificate by the Civil Aeronautics Board on May 22, 1946.

Summit Airways, Inc., Post Office Box 493, Laramie, Wyoming. President: Charles W. Hirsing, II.
This company was granted a temporary certificate by the Civil Aeronautics Board on March 28, 1946.

Transcontinental & Western Air, Inc. (T.W.A.), 101, West 11th Street, Kansas City 6, Mo.
Transcontinental and Western Air is using the trade name "Trans World Airline" on aircraft and in advertising but this is not a registered name.
Transcontinental and Western Air is divided into two operating divisions: Domestic Service Division and International Division.
Transcontinental and Western Air is associated with, or has investments in, the following transport companies:—
HAWAIIAN AIRLINES, LTD. (HAWAII).
IRANIAN AIRWAYS COMPANY, (IRAN).
PHILIPPINE AIRLINES, INC. (PHILIPPINE).
ETHIOPIAN AIR LINES (ETHIOPIA).

United Air Lines, Inc., 5959, South Cicero Avenue, Chicago 38, Illinois. President: W. A. Patterson.
Lineas Aereas Mineras, S.A. (L.A.M.S.A.) is the Mexican subsidiary of United Air Lines.
On July 2, 1946, United was authorized to fly between San Francisco and Hawaii.

Western Air Lines, Inc., 6331, Hollywood Boulevard, Los Angeles 28, Calif. President: Terrell C. Drinkwater.
As on July 1, 1946, Western Air Lines held 93 per cent. of the stock of Inland Air Lines.

West Coast Airlines, Inc., Box 544, Georgetown Station, Seattle 8, Washington. President: Nick Bez.
This company was granted a temporary certificate by the Civil Aeronautics Board on May 22, 1946.

E. W. Wiggins Airways, Inc., Norwood, Mass. President: Joseph Garside.
This carrier was granted a temporary certificate by the Civil Aeronautics Board on June 13, 1946.

Ray Wilson, Inc., Stapleton Airfield, Denver 7, Colorado. President: R. M. Wilson.
This carrier was granted a temporary certificate by the Civil Aeronautics Board on March 28, 1946. It has applied to the Board for permission to change its name to Monarch Air Lines, Inc.

NON-SCHEDULED AIR OPERATORS

Since the end of the war a new class of air transport operator has sprung into prominence in the United States—the non-scheduled operator or charter freight and passenger carrier—a class made up principally of ex-service personnel who have acquired surplus military aircraft, and have engaged in operations which only required them to conform to normal civil safety regulations and to have their aircraft licensed.

It is estimated that by June, 1946, there were at least 2,730 non-scheduled air-carriers operating 5,529 aircraft. These ranged from companies incorporated for more than $2,500,000 to small one-plane one-pilot concerns. From 300 to 400 were operating non-scheduled airlines between definite terminals or were engaged in contract carrier work.

C.A.A. figures revealed that the airline types of aircraft in the hands of non-scheduled operators included 101 Lockheed Lodestars, 13 Curtiss Commandos, 339 Douglas DC-3's and 76 Douglas DC-4's. In addition there were at least 2,000 smaller twin-engined and 3,000 single-engined aircraft used for charter operation of one sort or another.

The Civil Aeronautics Board was, at the time of writing, drafting regulations to bring these operators within its control and to enforce safety and economic regulations on all non-scheduled operators engaged in passenger and cargo carrying.

AIRPORTS OF ENTRY

On June 27, 1946, there were 45 airports and seaplane bases designated as airports of entry through which air-craft arriving in the United States may clear customs and immigration.

Airports of entry are designated by the Treasury Department after consultation with representatives of other interested Federal agencies and due consideration as to the necessity for such designation. Some are designated without time limit, while others are given temporary designation for the period of one year, as shown in the table below:—

Without Time Limit

Location	Name
Albany, New York	Municipal Field
Brownsville, Texas	Rio Grande Valley International Airport at Brownsville, Texas.
Buffalo, New York	Municipal Airport
Burlington, Vermont	Burlington Municipal Airport
Caribou, Maine	Caribou Municipal Airport
Cleveland, Ohio	Cleveland Municipal Airport
Detroit, Michigan	Detroit Municipal Airport
Detroit, Michigan	Ford Airport
Detroit, Michigan	Wayne County Airport
Douglas, Arizona	Douglas Airport
Duluth, Minnesota	Duluth Municipal Airport
Duluth, Minnesota	Duluth Boat Club Seaplane Base
Eagle Pass, Texas	Eagle Pass Airport
El Paso, Texas	Municipal Airport
Key West, Florida	Meacham Field
Miami, Florida	Pan-American Field (or 36th Street)
Miami, Florida	Dinner Key Seaplane Base
Nogales, Arizona	Nogales Municipal Airport
Ogdensburg, New York	Ogdensburg Harbor
Pembine, North Dakota	Fort Pembina Airport
Portal, North Dakota	Portal Airport
Port Townsend, Washington	Port Townsend Airport
Put-in-Bay, Ohio	Put-in-Bay Airport
Rochester, New York	Rochester Municipal Airport
Rouses Point, New York	Rouses Point Seaplane Base
San Diego, California	San Diego Municipal Airport (Lindbergh Field)
San Juan, Puerto Rico	Isla Grande Airport
Seattle, Washington	Boeing Municipal Air Field
Seattle, Washington	Lake Union
Swanton, Vermont	Missisquoi Airport
West Palm Beach, Fla.	Roosevelt Flying Service Base (Currie Common Park).
Massena, New York	Massena Airport

ALASKA

Civil Aviation in Alaska is administered by the U.S. Civil Aeronautics Administration through a Regional Office (Eighth Region) and the U.S. Civil Aeronautics Board, Alaska Office, both with headquarters in Anchorage.

TRANSPORT COMPANIES

The Civil Aeronautics Board has granted certificates to the following operators:—
Alaska Airlines, Inc., Alaska Coastal Airlines, Low Brennan Air Service, Bristol Bay Air Service, Nat Browne Flying Service, Christensen Air Service, Cordova Air Service, Dillingham Air Service, Jim Dodson Air Service, Ellis Air Transport, Ferguson Airways, Gillam Air Lines, Munz Air Service, Northern Cross, Pacific Northern Air Lines, Pan American Airways (for local services), Peck and Rice Airways, Peterburg Air Service, Ray Petersen Flying Service and Wien Alaska Airlines, Inc.

ALASKA—*continued.*

Each carrier is privileged to make charter trips to any point in Alaska. The Board has authorized an "irregular route service" in which areas of operations are defined but in which scheduled service by the irregular route carriers are not permitted if they conflict with the regular route of another carrier.

The Pacific-Alaska Division of Pan American Airways operates scheduled services from Seattle, Wash., to Juneau and Fairbanks.

Northwest Airlines has been certificated to operate services from the United States to Japan and China, via Anchorage, but had not begun to operate in 1946.

AIRPORTS OF ENTRY

Without Time Limit

Location	Name
Fairbanks	Weeks Municipal Airfield
Juneau	Juneau Airport
Ketchikan	Ketchikan Airport
Skagway	Skagway Municipal Airport
Wrangell	Wrangell Seaplane Base

HAWAIIAN ISLANDS

(Territory of Hawaii)

ADMINISTRATION

Civil Aviation in the Hawaiian Islands is administered by the U.S. Civil Aeronautics Administration, through a Regional office (Ninth Region) with headquarters in Honolulu, T. H., and the Civil Aeronautics Board, Washington 25, D.C.

TRANSPORT COMPANIES

Hawaiian Airlines, Ltd., Inter-Island Building, Honolulu, Hawaii. President: Stanley C. Kennedy.

The Inter-Island Steam Navigation Company owns 70.86% of Hawaiian's capital stock.

Pan American Airways, Inc., Pacific-Alaska Division.

Pan American Airways operates a daily service between San Francisco and Honolulu.

United Air Lines, Inc.

On July 2, 1946, the Civil Aeronautics Board authorized United Air Lines to operate air services between Honolulu, T.H., and San Francisco, California.

AIRPORTS

The Principal airport in the Hawaiian Islands is the Rodger's Airport at Honolulu, on the Island of Oahu. Other aerodromes are situated at Port Allen (Kauai), Hilo (Hawaii) and the islands of Molokai, Lanai, Maui and Hawaii.

PUERTO RICO

ADMINISTRATION

Civil Aviation in Puerto Rico is administered by the U.S. Civil Aeronautics Administration and the U.S. Civil Aeronautics Board, Washington 25, D.C.

TRANSPORT COMPANIES

Recorded below is a list of the American airline companies which are authorized to operate scheduled services to Puerto Rico.

Caribbean-Atlantic Airlines, Inc., 47, Recinto Sur Street, San Juan, P. R. President: Dionisio Trigo.

This company operates several daily flights between Mayaguez, San Juan and St. Croix.

Chicago and Southern Air Lines, Inc.

On May 17, 1946, the Civil Aeronautics Board authorized the carrier to engage in air transportation between New Orleans, La., Houston, Tex. and San Juan, P.R.

Eastern Air Lines, Inc.

On May 17, 1946, the Civil Aeronautics Board authorized Eastern Air Lines to engage in air transportation between Miami, Fla. and San Juan, P.R.

Pan American Airways, Inc, Latin American Division

Pan American Airways provides service between Miami Fla., Cuba and San Juan, P.R.

PHILIPPINE ISLANDS

(Commonwealth of the Philippines)

ADMINISTRATION

Civil Aviation in the Philippine Islands is administered by the Bureau of Aeronautics and the Public Service Commission located at Manila.

TRANSPORT COMPANIES

Philippine Air Lines, Inc., Soriano Building, Manila, Philippines. President: Col. Andres Soriano.

This company began flights on February 15, 1946.

Far Eastern Air Transport, Inc., Manila, Philippines.

This company began operations on November 19, 1945.

Pan American Airways, Inc., Pacific Division.

Service from the U.S.A. to the Philippines by Pan American Airways was resumed on January 20, 1947.

AERODROMES

Of eighty-eight airfields in the Philippines, 24 can be used by planes up to the size of DC-3's, and 8 additional airports can handle small planes. The remaining 56 fields need extensive repairs before they can be used. An international airport has been planned for Manila.

URUGUAY

(The Republic of Uruguay—Republica Oriental del Uruguay)

ADMINISTRATION

Civil Aviation is controlled by the Ministry of National Defence and is administered by the Direccion de Aeronáutica Civil. Address: 18 de Julio 2137, Montevideo. Director: Sr. José M. Peña.

An Air Convention exists between the Uruguayan and Argentine Governments regulating the traffic between the two capitals, and the Postal Authorities of the two countries have a close system of co-operation.

ASSOCIATION

Aero-Club del Uruguay, Paysandú 896, Montevideo. Aerodrome: Melilla. President: Sr. Luis A. Castagnola. Affiliated to the *Fédération Aéronautique Internationale* (F.A.I.) and to the *Comision Nacional de Educacion Fisica.*

NATIONAL TRANSPORT COMPANIES

Compania Aeronautica Uruguaya, S.A. (C.A.U.S.A.). Head Office: Calle Colonia 1088, Montevideo. President: J. Americo Beisso. Managing Director: Col. Tydeo Larre Borges. Manager: Raul Montero Zorrilla.

Primeras Lineas Uruguayas de Navegacion Aerea, Sociedad de Economia Mixta (P.L.U.N.A.). Head Office: Uruguay esq. Agraciada, Montevideo. President: Capt. Julio C. Poussin. General Manager: Delfin Diaz Cibils.

The conversion of this private but Government-subsidised company into a half private half state-owned company has at last been achieved. All services were suspended during the Parliamentary discussions on the subject.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Uruguay:—

British South American Airways (Great Britain).
Pan American World Airways (U.S.A.).
S.A. Empresade Viaçao Aerea Rio Gradense (Brazil).

CUSTOMS AIRPORTS

MONTEVIDEO (Carrasco). 18 km. from centre of city. The new national airport, not yet completed. Two runways N./S. and E./W. 1,700 × 48 m. are in operation.

MONTEVIDEO (Melilla). Lat 34°47'S., Long. 56°17'W. 16 kms. N.W. of city. Altitude 48.5 m. The most important in the country, is equipped for night flying. It has been enlarged considerably and improvements are near completion on the main runway, running N./S., which will be about 1,300 m. long. It is used by Pan American Airways, Varig, Pluna, and B.S.A.A.; also by the Aero Club del Uruguay and Centro de Aeronautica del Uruguay. It is the centre of all the Montevideo aeronautical sporting activities.

VENEZUELA

(United States of Venezuela—Estados Unidos de Venezuela)

ADMINISTRATION

Civil Aviation in Venezuela is controlled by the Ministerio de Guerra y Marina, Direccion de Aviacion, Esquina de Miraflores, Caracas. Director-General of Aviation: Colonel Luis Bruzual Bermudez.

PUBLICATION

Alas. Monthly Magazine. Editor: Pedro Perez Dupouy Apartado 1621, Caracas.

NATIONAL TRANSPORT COMPANIES

Aerovias Venezolanas, S.A. (Avensa).
Head Office: Apartado 943, Caracas. President: Henry L. Boulton. General Manager: Capt. Frank C. Martin.

Linea Aerea Taca de Venezuela, S.A.
Head Office: Conde a Carmelitas 2-3, Caracas. President: Pelro Vallenilla Echeverria.

This company is affiliated to the T.A.C.A. organization and has a capital of 2,100,000 Bolivares of which 55% is provided by Venezuelan citizens; the remaining 45% of the stock is held by the parent T.A.C.A. company.

Linea Aeropostal Venezolana.
Head Office: Carmelitas a Altagracia 25, Caracas. General Manager: Tenente Horacio Lopez Conde. Secretary-General: Salazar.

This is the Government-controlled airline for internal and international operations. It made its first survey flight to Europe with a Douglas C-54 on August 10, 1946. All pilots of the airline are either seconded from the Venezuelan Air Force or are former members of it.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Venezuela:—

British South American Airways Corpn. (Great Britain).
Sociedad Aerea Cruziero do Sol (Brazil).
K.L.M. (Netherlands West Indies).
Pan American World Airways (U.S.A.).

FLYING SCHOOL

Escuela de Aviacion Civil, Maracay. Director: Captain Leopoldo Vivas González.

Aircraft:—Four Aeronca 65CA, three Piper Cub trainers, three Piper Cub Coupés, one Fairchild 24, three Fleet 10 and one Fleet 11.

FLYING CLUB

"Ala Venezolana," Escuadrilla Interamericana. Address: Apartado 1621, Mercaderes a Gorda 16, Caracas.

This Club was organized in March, 1941, to develop Civil Aviation under the auspices of the "Inter-American Escadrille"

CUSTOMS AIRPORTS

Ciudad Bolivar. Lat. 8°08'N. Long. 63°33'W. Alt. 185 ft. 1½ miles S.E. of town. Size: 3,960 × 3,960 ft. Hangar 75 ft. high N.W. side. Airport of entry.

Coro. Lat. 11°26'N. Long 69°41'W. Alt. 65 ft. N.W. edge of town. 2 runways each 3,200 ft. Hangars. Airport of entry.

Maturin. Lat. 9°45'N. Long. 63°11'W. Alt. 110 ft. E. side of town. Landing strips N.E./S.W. 2,500 ft., E./W. 1,500 ft. No facilities. Airport of entry for customs.

Maracaibo (Grano de Oro). Lat. 10°40'N. Long. 71°39'W. Alt. 141 ft. 3 miles N.W. of town. 3 paved runways N./S. 3,727 ft., N.E./S.W. 2,943 ft., N.W./S.E. 2,986 ft. Large hangar. Repairs. W/T. call sign YVAI. Airport of entry.

Maracay (Boca del Rio). Lat. 10°15'N. Long. 67°38'W. Alt. 1,160 ft. 2 miles W. of town. Military and Commercial. 3 runways N.N.E./S.S.W. 2,302 × 120 ft., E./W. 3,272 × 120 ft., N.W./S.E. 2,959 × 120 ft. Administration building, hangars, etc. Full repairs. W/T. call sign YVWH.

There is a seaplane base with concrete ramp and hangar on shore of Lake Valencia, ½ mile S. of airport. Taxi strip from airport to S. base. Airport of entry for customs.

Porlamar. Lat. 10°58'N. Long. 63°52'W. Alt. S.L. N. edge of town. 2 runways each 3,280 ft. Boundary marks. No facilities. Customs airport of entry.

San Fernando. Lat. 7°52'N. Long. 62°27' Alt. 230 ft. 1½ miles E. of town. 3,000 × 900 ft. with runway 2,500 ft. Airport of entry.

YUGOSLAVIA

Yugoslavia is now within the Russian sphere of influence and few details of civil air activities in the country are available. The former national air line "Aeroput" has been dissolved and replaced by a new "democratised" concern with Russian assistance.

NATIONAL TRANSPORT COMPANY

Putnik. Head Office: Belgradė.

Details of this company are not available but it is believed to be operating with Russian PS-84 (DC-3) aircraft.

INTERNATIONAL TRANSPORT COMPANIES

The following companies are operating routes to and through Yugoslavia:—

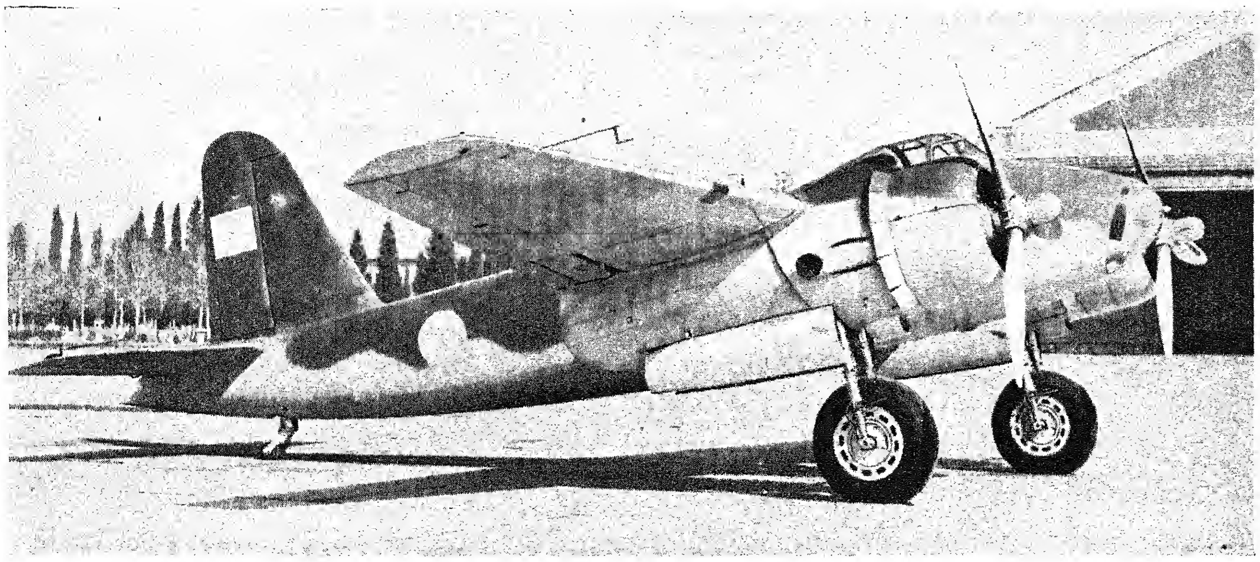
Ceskoslovenske Aerolinie (Czechoslovakia).
Soviet Air Lines (U.S.S.R.).

ALL THE WORLD'S AEROPLANES

(CORRECTED TO DECEMBER 31st, 1946.)

THE ARGENTINE REPUBLIC

MILITARY AIRCRAFT FACTORY.



The I.Ae. 24 Calquin Attack Bomber. (Two 1,050 h.p. Pratt & Whitney R-1830-SC-G engines).

INSTITUTO AEROTECNICO.

CORDOBA.

Director: Colonel D. Juan I. San Martin.

The Instituto Aerotecnico, formerly known as the Fabrica Militar de Aviones, which was established at Cordoba on October 10, 1927, now forms part of the Secretariat of Aeronautics. At the outset the factory built aeroplanes and aero-engines under licence, but since 1932 it has built several aeroplanes of its own design.

The first designs were the Ae.C.1 three-seat cabin monoplane and the Ae.C.2 two-seat training monoplane. These were followed, in 1933, by the Ae.T.1, the first commercial aeroplane to be built in the Argentine.

During 1934 the Ae.C.3 two-seat light training monoplane and the Ae.M.O.1 two-seat military training monoplane were produced. A number of the former was supplied to several civil flying schools in the Argentine and twelve of the latter were delivered to the Army in July, 1934. All these types have been illustrated and described in previous issues of this Annual. Licences have been held for the manufacture of the Curtiss Hawk 75-O single-seat fighter monoplane and the Focke-Wulf Fw 44 two-seat training biplane.

The factory has also built the Wright Cyclone and the Siemens Sh 14 air-cooled radial engines, as well as metal and wooden airscrews and other equipment. Several sailplanes have also been built for the flying clubs.

The two-seat light cabin monoplane known as the "El Boyero" was designed and built in 1939-40. The licence for the construction of this aeroplane was granted to the S. A. Sfreddo y Paolini but owing to the international situation it was impossible to obtain the necessary equipment and materials for this programme to proceed. The "El Boyero" has been illustrated and described in previous issues of this Annual.

The most recent products of the Instituto Aerotecnico are the I.Ae D.L.22, a two-seat Advanced Trainer, and the I.Ae 24 Calquin (Royal Eagle), a twin-engined Fighter-Bomber.

THE I.AE. 24 CALQUIN (ROYAL EAGLE).

The Calquin, which first flew in June, 1946, is the first twin-engined aircraft to be designed and built in Argentina. Designed by Colonel San Martin, it is an all-wood twin-engined mid-wing monoplane with a likeness to the D.H. Mosquito.

TYPE.—Twin-engined Attack Bomber.

WINGS.—Cantilever mid-wing monoplane. Wooden structure with sandwiched plywood skin. Balanced wooden ailerons with fabric covering. Controllable trim-tab in each. Wooden slotted trailing-edge flaps between ailerons and fuselage, with two small auxiliary flaps in each. Wing area 38 sq. m. (409 sq. ft.).

FUSELAGE.—Oval-section monocoque structure with sandwiched plywood skin.

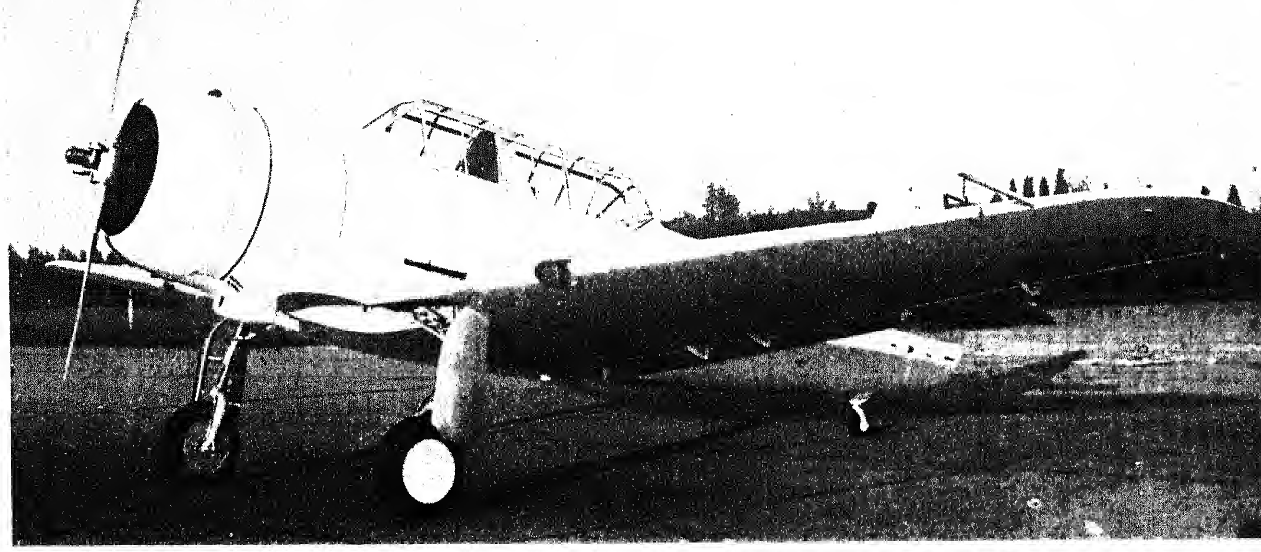
TAIL UNIT.—Cantilever monoplane type with forwardly-placed fin and rudder. Wooden structure, with ply-covered fin and tail-plane. Balanced rudder and elevators have plywood leading-edge and fabric covering. Controllable trim-tabs in elevators.

LANDING GEAR.—Retractable two-wheel type. Main wheels each carried between pair of oleo-pneumatic shock-absorber legs which retract rearwards into engine nacelles and are enclosed by twin doors. Hydraulic operation and hydraulic brakes. Tail-wheel retracts rearwards into fuselage.

POWER PLANT.—Two 1,050 h.p. Pratt & Whitney R-1830-SC-G Twin-Wasp fourteen-cylinder two-row radial air-cooled engines enclosed in long-chord cowlings with controllable trailing-edge gills, and driving Hamilton Standard Hydromatic 23-E-50 three-blade metal airscrews.

The I.Ae D.L. 22 Two-seat Advanced Trainer (450 h.p. I.Ae.16 El Gaucho engine).

MILITARY AIRCRAFT FACTORY—continued.



The I.Ae D.L. 22-C Two-seat Advanced Training Monoplane (475 h.p. Armstrong Siddeley Cheetah 25 engine).

ACCOMMODATION.—Crew of two consisting of pilot in enclosed cockpit and bombardier in nose.
ARMAMENT.—Four 20 m/m. cannon mounted in nose. Bomb-load 800 kg. (1,764 lbs.) in internal bomb-bay.
DIMENSIONS.—Span 16.30 m. (53 ft. 5¾ in.), Length 12.00 m. (39 ft. 4½ in.), Height 3.40 m. (11 ft. 4¼ in.).
WEIGHTS AND LOADINGS.—Weight loaded 6,500 kg. (14.330 lb.), Wing loading 170.9 kg./sq. m. (35 lbs./sq. ft.), Power loading 3.08 kg./h.p. (6.8 lbs./h.p.).
PERFORMANCE.—No data available.

THE I.AE. D.L.22.

TYPE.—Two-seat Advanced Trainer.
WINGS.—Cantilever low-wing monoplane. Wooden structure with sandwiched plywood skin. Balanced ailerons with trim-tab in each and Lachmann-type trailing-edge flaps of wooden construction. Wing area 23.19 sq. m. (249.5 sq. ft.).
FUSELAGE.—Oval-section monocoque structure. Wooden construction with plywood covering.
TAIL UNIT.—Cantilever monoplane type. Wooden structure with ply-covered fin and tailplane. Balanced rudder and elevators have plywood leading-edge and fabric covering. Controllable trim-tab in each.
LANDING GEAR.—Retractable two-wheel type. Each main wheel carried in half-fork on oleo-pneumatic shock-absorber leg retracts inwards under wing and fuselage and is contained in well projecting ahead of leading-edge. Electric operation, with manual emergency gear. Hydraulic brakes. Non-retractable tail-wheel.
POWER PLANT.—One 450 h.p. I. Ae. 16 El Gaucho nine-cylinder radial air-cooled engine driving Hamilton Standard 2M-D-30 two-blade two-position wooden airscrew.
ACCOMMODATION.—Two tandem cockpits for pilot and pupil with continuous transparent canopy. Dual controls.
DIMENSIONS.—Span 12.60 m. (41 ft. 4⅞ in.), Length 9.20 m. (30 ft. 2½ in.), Height 2.82 m. (9 ft. 3 in.).
WEIGHTS AND LOADINGS.—Weight empty 1,520 kg. (3,351 lbs.), Weight loaded 2,220 kg. (4,994 lbs.), Wing loading 100 kg./sq. m. (20.05 lbs./sq. ft.), Power loading 5.23 kg./h.p. (11.53 lbs./h.p.).
PERFORMANCE.—Maximum speed 290 km.h. (180 m.p.h.) at 450 m. (1,475 ft.), Cruising speed (1,900 r.p.m.) 260 km.h. (162 m.p.h.), Landing speed 110 km.h. (68 m.p.h.), Ceiling 5,200 m. (17,060 ft.), Range 1,200 km. (746 miles).

THE I.AE. D.L.22-C.

The D.L.22-C is basically the same as the D.L.22 but is powered by a 475 h.p. Armstrong Siddeley Cheetah 25 seven-cylinder radial air-cooled engine driving a Rotol two-blade constant-speed airscrew.
PERFORMANCE.—Maximum speed 305 km.h. (190 m.p.h.) at 450 m. (1,475 ft.), Cruising speed 275 km.h. (171 m.p.h.), Ceiling 5,500 m. (18,045 ft.).

IMPA.

COMPANIA INDUSTRIA METALÚRGICA & PLÁSTICA S.A.

HEAD OFFICE: BUENOS AIRES.

AIRCRAFT WORKS: QUILMES AIRPORT, BUENOS AIRES.

The Compania Industria Metalúrgica & Plástica S.A. was originally formed to take over the firm of Lieneu & Cia, formerly agents for the Fisk Tyre & Rubber Company and Argentine distributors for Chrysler automobiles. It manufactures aluminium, lead and plastic articles and has undertaken the manufacture of munitions for the Argentine Armed Forces.

In September, 1941, the Company started an aircraft department under the direction of Senor José Mario Sueiro, and in December, 1944, a new factory was opened on the Quilmes Airport.

The first aeroplane built by the Company was a light two-seat cabin monoplane known as the Impa RR-11 which made its first flight at the General Pacheco Airport, near Buenos Aires, on July 25, 1942.

A second prototype, the Impa Tu-Sa-O, made its first flight on April 17, 1943. A small series of this model was built for flying club use but after a number of accidents the type was withdrawn from service.

In addition to development work on a number of projected prototypes the company has built a small quantity of primary training gliders.

TUCAN.

SOCIEDAD ANONIMA SFREDDO & PAOLINI.

HEAD OFFICE AND WORKS: M. IRIGOYEN 630, CASTELAR BUENOS AIRES.)

This concern was originally formed in 1916 by Senores Jorge Sfreddo and Luis Paolini.

It was successful in tendering for the serial manufacture under licence of the "El Boyero" light cabin monoplane designed and built by the Military Aircraft Factory, but owing to the difficulty of obtaining the necessary materials and equipment it has been unable to proceed with its programme.

It has also built to the designs of Ing. Alfredo Turbay, a light single-seat touring monoplane known as the Tucan T-1. This aircraft was illustrated and described in the last issue of this Annual.

BELGIUM

FAIREY.

AVIONS FAIREY S.A.

Head Office, Works and Aerodrome: Gosselies.

Managing Director: E. O. Tips.

The works and offices of Avions Fairey S.A., which company was formed in 1933 as a Belgian concern in which the British Fairey Aviation Co., Ltd. held an interest, were destroyed by bombing on May 10, 1940. The major part of the equipment and stock of materials, together with all technical data, were salvaged and eventually reached England with part of the senior staff.

The aerodrome was occupied by the Germans during the occupation and by the U.S. Army Air Forces after the liberation.

The factory has now been rebuilt and is in working order again to deal with the design and manufacture of military and civil aircraft.

RENARD.

CONSTRUCTIONS AÉRONAUTIQUES G. RENARD.

Head Office and Works: 34-36, Avenue Jules Bordet, Evère, near Brussels.

Before the war the Renard company designed and built several types of military aircraft, including the R.31 two-seat reconnaissance monoplane with a Rolls-Royce Kestrel engine, and the R.36, R.37 and R.38 single-seat fighters with Hispano-Suiza 12Y, Rolls-Royce Merlin and Gnôme-Rhône K.14 engines respectively. The R.31 was produced in numbers both by Renard and by the S.A.B.C.A. concern under licence for the Belgian Air Arm.

Throughout the war the company was inactive but reorganization was begun towards the end of 1945.

Renard is now preparing designs for two civil aircraft, the R.44 light twin-engined four-passenger transport with fixed tricycle landing-gear and pusher propellers; and the R.46, a large twin-engined twin-boom cargo transport with a central freight hold with a capacity for 5,000 kg. (11,023 lbs.) of useful load. This aircraft will have a retractable tricycle landing-gear and tailplane mounted halfway up the fins to permit trucks to drive under the tail and between the booms for direct loading and unloading through split doors forming the rear end of the central fuselage. No further details of these two aircraft were available for publication at the time of writing.

S.A.B.C.A.

SOCIÉTÉ ANONYME BELGE DE CONSTRUCTIONS AÉRONAUTIQUES.

Head Office: 13, Rue de Brédérode, Brussels.

The Société Anonyme Belge de Constructions Aéronautiques was, before the late war, the largest aircraft works in Belgium and in addition to building aircraft and aero-engines for the Belgian Government and the S.A.B.E.N.A. company, it also designed and built aircraft of original design.

Throughout the war the company's factory was occupied by the enemy. It was seriously damaged in Allied bombing attacks and most of its machinery and equipment was dispersed. So far, the company has been unable to resume any aeronautical activity.

STAMPE-ET-VERTONGEN.

J. STAMPE AND M. VERTONGEN.

Head Office and Works: 130, Rue Drakenhof, Antwerp.

Paris Office: 4, Rue Alfred Roll, Paris (17e).

Directors: J. Stampe and M. Vertongen.

This firm, which was established in 1922, has always specialised in the construction of primary and advanced training aircraft. Its best-known and most widely-used pre-war aircraft was the S.V.4B, a light two-seat training and touring biplane.

The company's factory at Deurne-Sud, near Antwerp, was destroyed during the war mainly by V.1 weapons, but it is being rebuilt and construction of the S.V.4B will be resumed there.

The S.V.4C with a Renault Bengali engine has been ordered in quantity by the French Government (1,000 aircraft) for use in France and her Colonies and is now being built in France by the Société Nationale de Constructions Aéronautiques du Nord (S.N.C.A.N.) and by the Atelier Industriel de l'Aéronautique d'Alger in Algiers, North Africa.

TIPSY.

AVIONS TIPSY.

Head Office, Works and Aerodrome: Gosselies, near Charleroi.

Mr. E. O. Tips, Managing Director of Avions Fairey S.A., designed and built in 1935 a light single-seat touring monoplane known as the Tipsy. This machine and the two-seat versions which followed met with considerable success and licences for their construction were acquired in England, France, Spain and South Africa.

Production of the two-seat Tipsy is now being resumed under the name Belfair. The prototype Belfair was the first aeroplane built in Belgium since the war.

THE TIPSY BELFAIR.

Type.—Two-seat Light Monoplane.

Wings.—Low-wing cantilever monoplane. Wing in one piece and attached to the fuselage by four bolts. Wooden structure round a single box-spar located at the deepest point of the wing section. Leading-edge to main spar covered with plywood, remainder with fabric glued to spars and former ribs. Gross wing area 12 sq. m. (129 sq. ft.). Differentially-operated ailerons. Two-position landing flaps between ailerons and fuselage.

Fuselage.—Spruce framework covered on sides and bottom with plywood. Roof in region of cockpit has spruce framework and plywood covering, remainder of domed roof covered with fabric over light fairing structure of duralumin tube formers and spruce longitudinal stringers.

Tail Unit.—Braced monoplane type. Fin built integral with the fuselage. Wooden framework with fabric covering.

Landing Gear.—Fixed cantilever type. Consists of two vertical forks with rubber-in-compression springing anchored at their upper ends to fittings bolted to the front face of the main wing spar. Steerable tail-wheel.

Power Plant.—One 65 h.p. Walter Mikron III four-cylinder in-line inverted air-cooled engine. Fuel tank (65 litres=12 Imp. gallons) in fuselage behind fireproof bulkhead. Oil tank (8 litres=1¾ Imp. gallons) in engine compartment.

Accommodation.—Cockpit seating two side-by-side in slightly staggered seats. Central control column. Dual rudder pedals. Large moulded windscreen. Top of cabin, of transparent material, hinges, in two halves, to give access. Baggage compartment behind seats.

Dimensions.—Span 9.5 m. (31 ft. 2 in.), Length 6.6 m. (21 ft. 8 in.), Height 2.1 m. (6 ft. 11 in.).

Weights and Loadings.—Weight empty 245 kg. (540 lbs.) Weight loaded 500 kg. (1,102 lbs.) Wing loading 41.7 kg./sq. m. (8.5 lbs./sq. ft.) Power loading 8.07 kg./h.p. (17.8 lbs./h.p.).

Performance.—Maximum speed 185 km.h. (115 m.p.h.), Cruising speed 150-165 km.h. (93-103 m.p.h.), Stalling speed 64 km.h. (40 m.p.h.), Initial rate of climb 143 m./min. (469 ft./min.), Service ceiling 6,000 m. (19,680 ft.), Range 750 km. (465 miles), Take-off run (still air) 80 m. (90 yds.), Landing run (still air) 65 m. (70 yds.).

BRAZIL

CONSTRUCOES AERONAUTICAS S.A.

Head Office : Rio de Janeiro.

Works : Lagõa Santa, Minas Geraes.

President : Señor Francisco Pignatari.

General Manager : Eng. Jorge da Rocha Fragoso.

In May, 1940, the Brazilian Government signed an agreement guaranteed by the Ministries of War and Marine, for the formation of an aircraft manufacturing company which has erected a factory on a site provided by the Government at Lagõa Santa, in the province of Minas Geraes.

The new firm has been given a concession to manufacture both military and civil aircraft and the Government undertakes to place orders to a predetermined value over a period of 15 years. The first military type to be built is the North American NA-16 (AT-6) advanced training monoplane.

Brazilian materials must be used as far as possible. During the first year of production the company must employ native Brazilians in at least 50 per cent. of the general, administrative and commercial management positions ; 30 per cent. in directional and technical services ; 75 per cent. in commercial and administrative work ; and 30 per cent. in shop work. These percentages will increase in succeeding years.

FABRICA BRASILIERA DE AVIÕES.

Works : Ilha do Viana, Rio de Janeiro.

This is the former Army air workshops. It builds training aeroplanes for the Brazilian Air Force. These have included the M-7 and M-9 two-seat primary training biplanes, designed by Colonel Antonio Muniz.

It is now engaged in the production under licence of a series of Fairchild M-62 (PT-19) two-seat primary training monoplanes for the Brazilian Air Force.

FABRICA DO GALLEÃO.

Works : Ponto do Galleão, Ilha do Governador, Rio de Janeiro.

Director : Ten. Col. Av. Eng. Joelmir C. Araripe Macedo.

The Fabrica do Galleão, the former naval air workshops, builds aircraft for the Brazilian Air Force. The establishment, in addition to its aircraft manufacturing facilities, includes a laboratory of mechanical research with physical and chemical test laboratories etc., an engine test department, an aircraft plywood plant with an electric drier for wood with a capacity of 20 cub. m., a wooden airscrew plant, etc. It has a covered area of over 30,000 sq. m., and employs about 1,500 hands.

It has built two series of Focke-Wulf aircraft, forty Fw 44 two-seat primary trainers and twenty-five Fw 58 twin-engined advanced training monoplanes.

It is now building the Fairchild M-62 (PT-19) primary training monoplane under a licence granted to the Brazilian Government by the Fairchild Engine & Airplane Corporation.

C.A.P.

COMPANHIA AERONÁUTICA PAULISTA.

Head Office and Works : Rua Dr. Falcão Filho, 56-12, São Paulo.

President : Sr. H. Martini.

The Companhia Aeronáutica Paulista, a subsidiary of the Laminação de Metais S.A., was recently formed to build and repair aircraft, etc. It has so far produced three light aeroplanes of original design, the C.A.P. 1 Planalto, the C.A.P. 4 Paulistinha, and the C.A.P.5 Carioca. All are in production.

The company is also building the Saracura primary and Alcatraz secondary training gliders.

THE C.A.P.5 CARIOCA.

The C.A.P.5 is a light touring monoplane with accommodation for two side-by-side with dual controls. The structure includes a welded steel-tube fuselage and plywood-covered wooden wings. The power-plant consists of a 90 h.p. Franklin four-cylinder horizontally-opposed air-cooled engine. No further details were available at the time of writing.

THE C.A.P. 4 PAULISTINHA.

Type.—Two-seat Light Primary Training and Touring monoplane.

Wings.—High-wing braced monoplane. Wings attached direct to built-in centre-section on top of fuselage and braced to lower longerons by streamline steel-tube V-struts. Two-spar wooden structure with fabric covering. Slotted ailerons on under-hung hinges. Fixed slots in leading-edge ahead of ailerons. Gross wing area 17 sq. m. (183 sq. ft.).

Fuselage.—Rectangular welded steel-tube framework covered with fabric over light wooden fairing structure.

Tail Unit.—Wire-braced monoplane type. Welded steel-tube framework covered with fabric. Tie-rod bracing above and below in plane of main tubular spar of tailplane.

Landing Gear.—Divided type. Consists of two side Vees and two inclined half-axles hinged at their inner ends to a Vee cabane beneath the fuselage. Oleo shock-absorber struts form front legs of side Vees. Medium-pressure wheels and brakes.

Power Plant.—One 65 h.p. Franklin four-cylinder horizontally-opposed air-cooled engine on welded steel-tube mounting. Two-blade wooden airscrew. Fuel capacity 58 litres (12.8 Imp. gallons). Oil capacity 4 litres (0.88 Imp. gallons).

Accommodation.—Enclosed cabin seating two in tandem with dual controls. Entrance door on starboard side. Space for baggage behind rear seat.

The C.A.P. 4 Paulistinha Two-seat Cabin Monoplane (65 Franklin h.p. engine).

The C.A.P. 4C Paulistinha Radio Light Observation and Liaison Monoplane (65 h.p. Franklin engine).

DIMENSIONS.—Span 10.1 m. (33 ft. 1⅜ in.), Length 6.65 m. (21 ft. 9⅞ in.), Height 1.95 m. (6 ft. 4¾ in.).

WEIGHTS AND LOADINGS.—Weight empty 320 kg. (706 lbs.), Weight loaded 540 kg. (1,190 lbs.), Wing loading 31.8 kg./sq. m. (6.51 lbs./sq. ft.), Power loading 8.3 kg./h.p. (18.3 lbs./h.p.).

PERFORMANCE.—Maximum speed 155 km.h. (96.5 m.p.h.), Cruising speed 140 km.h. (87.2 m.p.h.), Initial rate of climb 185 m./min. (610 ft./min.), Service ceiling 4,000 m. (13,120 ft.), Range 500 km. (311 miles).

THE C.A.P. 4B AMBULANCIA.

This is a special version of the C.A.P. 4 arranged to carry one stretcher case. The fuselage deck from trailing-edge of wing to tailplane is hinged to open sideways to permit the loading and unloading of the stretcher, the head portion of which extends into the rear portion of the cabin and takes the place of the second seat.

THE C.A.P. 4C PAULISTINHA RADIO.

The C.A.P. 4C is a light military observation and liaison monoplane converted from the C.A.P. 4. The fuselage aft of the cabin is cut down in depth, the side windows of the cabin are extended aft, the roof is glazed and the rear end of the upper half of the cabin is provided with a sloping window. The passenger is seated with his back to the pilot and is provided with a radio receiving and transmitting set with a transmitting range of 480 km. (300 miles).

THE C.A.P. 1 PLANALTO.

TYPE.—Two-seat Advanced Training monoplane.

WINGS.—Low-wing cantilever monoplane. Constant taper from roots to tips. Small flat centre-section with outer wings set at dihedral angle. Two-spar wooden wing framework with fabric covering. Split flaps between ailerons and centre-section. Gross wing area 12 sq. m. (129.2 sq. ft.).

FUSELAGE.—Oval wooden monocoque with plywood skin.

TAIL UNIT.—Cantilover monoplane type. All-wood framework with fabric-covered rudder and elevators.

LANDING GEAR.—Fixed divided type. Cantilever single-leg shock-absorber struts attached to extremities of centre-section front spar. Medium-pressure wheels. Wheel-brakes. Tail-skid.

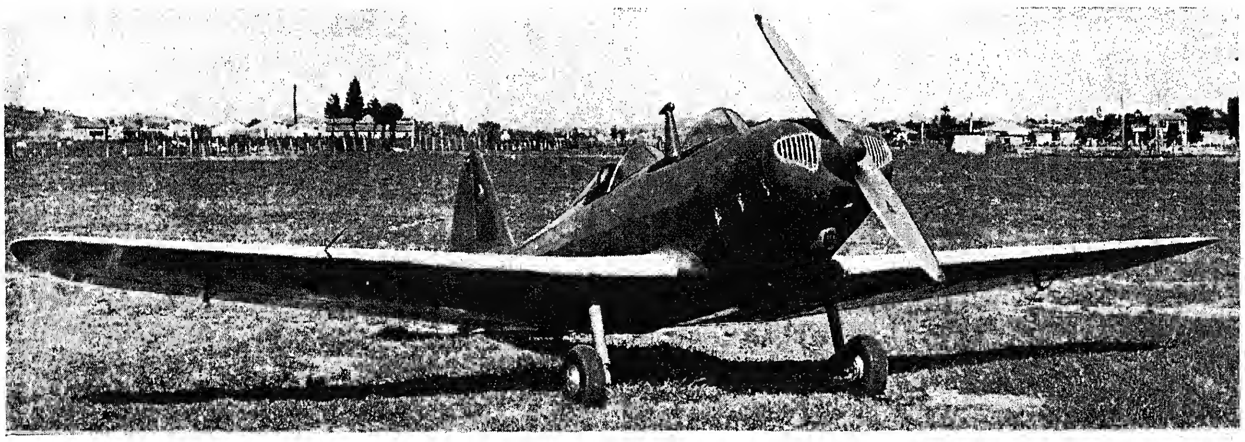
POWER PLANT.—One 90 h.p. Franklin four-cylinder horizontally-opposed air-cooled engine. Two-blade wooden airscrew. Fuel capacity 70 litres (15.4 Imp. gallons). Oil capacity 4 litres (0.88 Imp. gallons).

ACCOMMODATION.—Tandem open cockpits with complete dual controls. Turn-over post between cockpits.

DIMENSIONS.—Span 8.6 m. (28 ft. 2½ in.), Length 6.5 m. (21 ft. 9⅞ in.), Height 2.15 m. (7 ft. 1 in.).

WEIGHTS AND LOADINGS.—Weight empty 440 kg. (970 lbs.), Weight loaded 670 kg. (1,480 lbs.), Wing loading 55.8 kg./sq. m. (11.4 lbs./sq. ft.), Power loading 7.4 kg./h.p. (16.3 lbs./h.p.).

PERFORMANCE.—Maximum speed 185 km.h. (115.2 m.p.h.), Cruising speed 170 km.h. (106 m.p.h.), Initial rate of climb 192 m./min. (630 ft./min.), Service ceiling 4,000 m. (13,120 ft.), Range 500 km. (311 miles.).



The C.A.P. 1 Planalto Two-seat Advanced Training Monoplane (90 h.p. Franklin engine).

C.N.N.A.

CIA. NACIONAL DE NAVEGAÇAO AÉREA.

HEAD OFFICE: AVENIDA RODRIGUES ALVES 303/31, RIO DE JANEIRO.

WORKS: PRAIA DO CAJÚ No. 68, RIO DE JANEIRO.

Director and Chief Engineer: Valencio Barros.

The Companhia Nacional de Navegação Aérea is one of the group of companies belonging to the Organização Henrique Lage—Patrimonio Nacional.

The Company has designed and produced a number of aircraft including the HL-1, HL-2, HL-4 and the HL-6, and in 1943 was engaged in the production of fifty of the latter type. The latest version is designated the HL-6 Series B Cauré, and a specification and illustration of this model follow.

The latest version of the HL-1 is designated the HL-1 Series B and a photograph and brief description of this aircraft appears on the next page.

THE C.N.N.A. HL-6 SERIES B CAURÉ.

TYPE.—Two-seat Primary Training or Touring monoplane.

WINGS.—Cantilever low-wing monoplane. Structure consists of two plywood box-spars, Warren-type ribs and diagonal members. Ply-covered leading-edge, and fabric covering aft to trailing-edge. Statically-balanced ailerons; upward movement 30 degrees; downward movement 15 degrees. Wing area 15 sq. m. (161.4 sq. ft.).

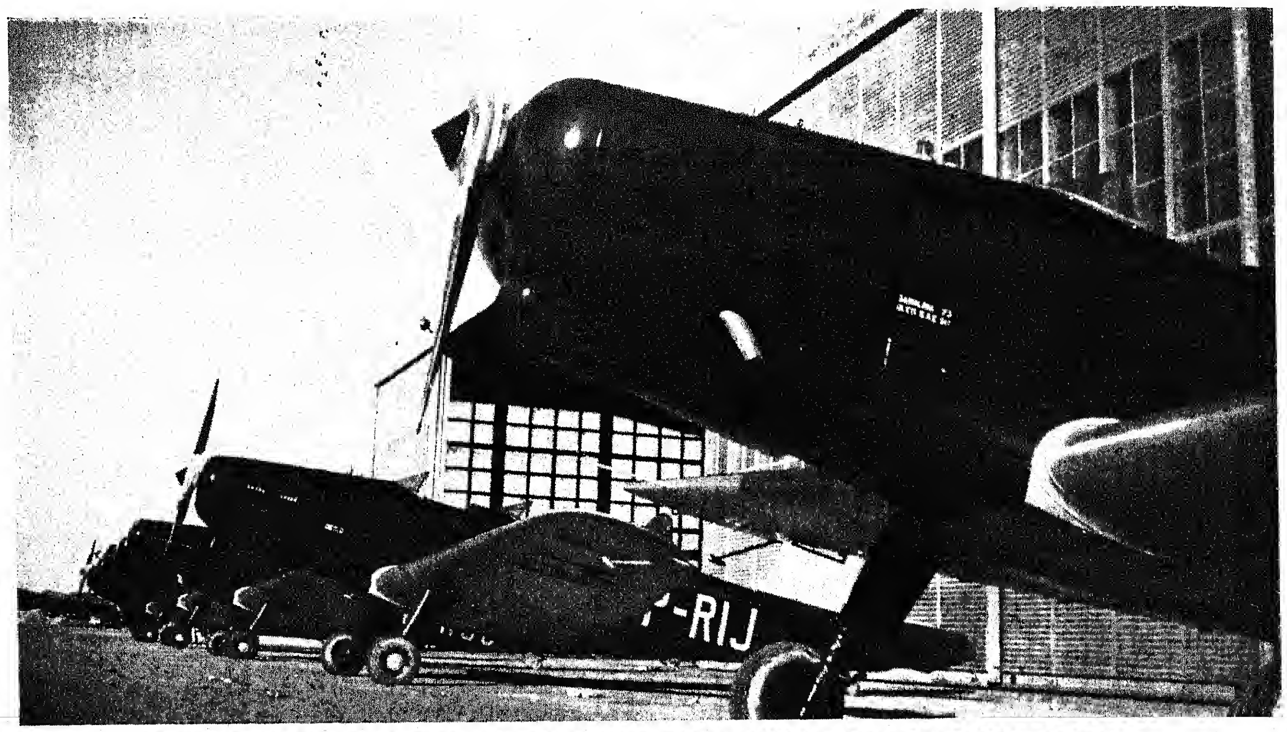
FUSELAGE.—Wooden structure. Four main longerons, cross members and plywood and fabric covering.

TAIL UNIT.—Cantilever monoplane type, with forwardly-placed fin and rudder. Structure as wings. Fin integral with fuselage. Statically-balanced elevators and aerodynamically-balanced rudder.

LANDING GEAR.—Fixed two-wheel type. Single cantilever shock-absorber legs carrying main wheels with Goodyear 8.00 × 4 tyres. Tyre pressure 1.1 kg./sq. c/m. (16 lbs./sq. in.). Mechanically-operated brakes. Track 2.7 m. (8 ft. 10 in.). Tail-skid.

POWER PLANT.—One Lycoming O-290-C four-cylinder horizontally-opposed air-cooled engine rated at 125 h.p. at 2,600 r.p.m. and

***C.N.N.A.**—continued.*



A line of C.N.N.A. HL-6 Series B Cauré Two-seat Trainers (125 h.p. Lycoming O-290-C engines).

with a maximum take-off power of 130 h.p. at 2,800 r.p.m. Bendix-Scintilla SF4L-8 magneto ; Marvel-Schebler MA-3 SPA carburettor. Two-blade fixed-pitch wooden airscrew. Fuel capacity (Trainer) 88 litres (19 Imp. gallons), (Tourer) 185 litres (41 Imp. gallons), Oil capacity 7.5 litres (1.7 Imp. gallons).

Accommodation.—Two open tandem cockpits for pilot and passenger. Dual controls.

Dimensions.—Span 9.8 m. (32 ft. 2 in.), Length 7.2 m. (23 ft. 7 in.), Height (tail down, airscrew horizontal) 2.04 m. (6 ft. 8¼ in.).

Weights and Loadings (Trainer).—Weight empty 545 kg. (1,202 lbs.), Pilot 75 kg. (165 lbs.), Pupil 75 kg. (165 lbs.), Two parachutes 20 kg. (44 lbs.), Fuel 30 kg. (66 lbs.), Oil 5 kg. (11 lbs.), Weight loaded 750 kg. (1,653 lbs.), Wing loading 50 kg./sq. m. (10 lbs./sq. ft.), Power loading (take-off power) 6 kg./h.p. (13.23 lbs./h.p.).

Weights and Loadings (Tourer).—Weight empty 545 kg. (1,202 lbs.), Battery 15 kg. (33 lbs.), Pilot 80 kg. (176 lbs.), Passenger 80 kg. (176 lbs.), Fuel 63 kg. (139 lbs.), Oil 7 kg. (15 lbs.), Baggage 10 kg. (22 lbs.), Weight loaded 800 kg. (1,763 lbs.), Wing loading 53.3 kg./sq. m. (10.9 lbs./sq. ft.), Power loading (take-off power) 6.4 kg/h.p. (14.1 lbs./h.p.).

Performance (Trainer).—Maximum speed 200 km.h. (124 m.p.h.), Cruising speed (70% power) 180 km.h. (112 m.p.h.), Stalling speed 85 km.h. (53 m.p.h.), Rate of climb 270 m./min. (886 ft./min.), Climb to 1,000 m. (3,280 ft.) 4.2 minutes, Theoretical ceiling 5,200 m. (17,060 ft.), Service ceiling 4,500 m. (14,765 ft.), Radius of action (at 2,200 r.p.m.) 260 km. (161 miles), Take-off run 100 m. (109 yds.).

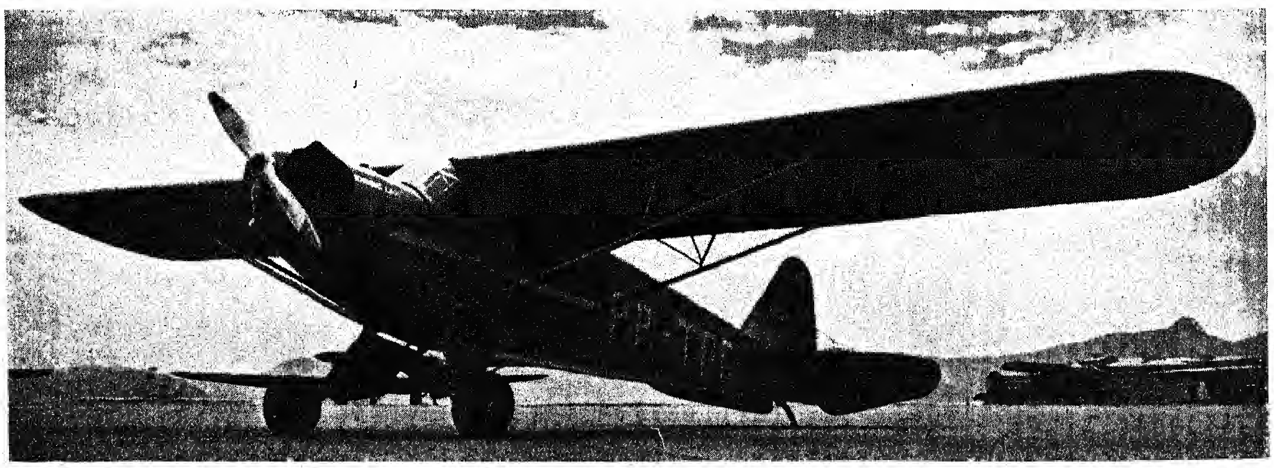
Performance (Tourer).—Maximum speed 195 km.h. (121 m.p.h.), Cruising speed (70% power) 175 km.h. (109 m.p.h.), Stalling speed 88 km.h. (55 m.p.h.), Rate of climb 180 m./min. (590 ft./min.), Climb to 1,000 m. (3,280 ft.) 6.3 minutes, Service ceiling 2,800 m. (8,195 ft.), Absolute ceiling 3,400 m. (11,155 ft.), Radius of action (at 2,200 r.p.m.) 550 km. (342 miles), Take-off run 115 m. (126 yds.).

THE C.N.N.A. HL-1 SERIES B.

The C.N.N.A. HL-1 Series B is a two-seat strut-braced high-wing cabin monoplane closely resembling the American Piper Cub. It is similarly constructed, with a welded steel-tube fuselage and fabric covering, and fabric-covered wooden wings. It is powered by a 65 h.p. Continental A65-8 four-cylinder horizontally-opposed air-cooled engine driving a two-blade fixed-pitch wooden airscrew. The fuel capacity (73-Octane) is 50.5 litres (12.1 Imp. gallons), and the oil capacity 3.8 litres (0.83 Imp. gallons).

Weights and Loadings.—Weight empty 340 kg. (750 lbs.), Pilot and passenger 160 kg. (353 lbs.), Fuel and oil 40 kg. (88 lbs.), Baggage 20 kg. (44 lbs.), Equipment 20 kg. (44 lbs.), Weight loaded 580 kg. (1,279 lbs.), Power loading 8.9 kg./h.p. (19.6 lbs./h.p.).

Performance.—Maximum speed 150 km.h. (93 m.p.h.).



The C.N.N.A. HL-1 Series B Two-seat Cabin Monoplane (65 h.p. Continental A65-8 engine).

I.P.T.

INSTITUTO DE PESQUIZAS TECNOLOGICAS (Institute of Technical Research).

Head Office : São Paulo.

Chief of the Scientific Department : Eng. Frederico Abranches Brotero.

This establishment, which is principally engaged in research, particularly with regard to the qualities of national materials suitable for use by the Brazilian Aircraft Industry, has built two aircraft, the I.P.T. 0 Bichinho and the I.P.T. 7 Junior. These are purely experimental prototypes and are not intended for commercial production. They employ materials and equipment of national origin, notably structural members, plywood and airscrews of indigenous timbers, the qualities of which are being investigated by the I.P.T. No details of these two aircraft were available for publication at the time of writing.

THE BRITISH EMPIRE
GREAT BRITAIN

AIRSPEED.

AIRSPEED, LTD.

HEAD OFFICE: THE AIRPORT, PORTSMOUTH, HANTS.
WORKS: PORTSMOUTH AND CHRISTCHURCH, HANTS.
Chairman: A. S. Butler.
Director and General Manager: A. Townsley.
Technical Director and Director of Design: A. E. Hagg.
Directors: G. Wigham Richardson, F. T. Hearle, F. E. N. St. Barbe, W. E. Nixon, P. E. Gordon-Marshall and J. Liddell, A.C.A. (Secretary).

Airspeed (1934) Ltd., was registered in August, 1934, when Airspeed, Ltd., became associated with the famous Tyneside shipbuilding firm of Swan, Hunter and Wigham Richardson, Ltd.

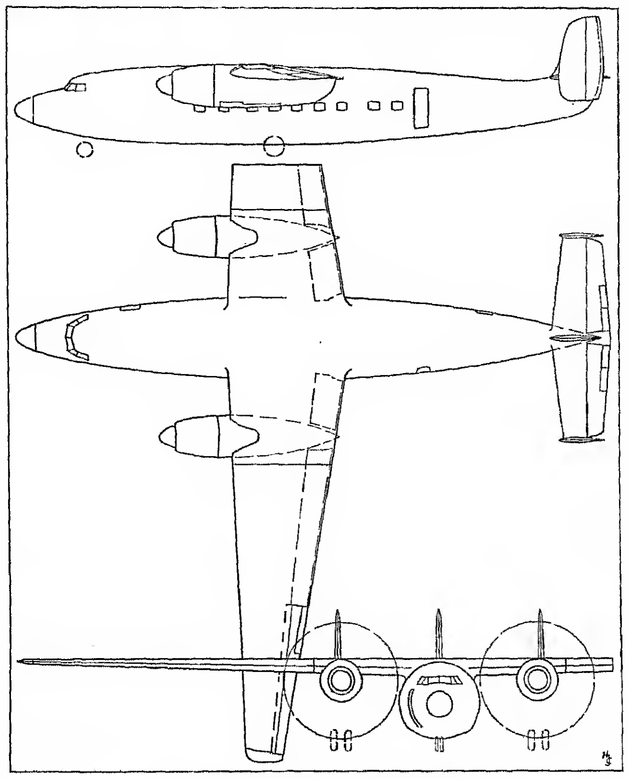
In 1940 the de Havilland Aircraft Co. Ltd. acquired from Swan, Hunter & Wigham Richardson Ltd. that company's holding of ordinary shares in Airspeed (1934) Ltd. The Company, however, retains its separate identity. On January 25, 1944, the name was changed to Airspeed, Ltd.

An important production of the Company was the Oxford twin-engined training monoplane, large numbers of which were also built by other aircraft manufacturers. Some 9,000 Oxfords were delivered to the Royal Air Force and to the Air Forces of the Empire during the War, and it still remains the standard twin-engined trainer of the R.A.F.

Airspeed were also responsible for the design and manufacture of the Horsa transport glider, which was also widely sub-contracted. It was used with success in the airborne invasions of Sicily, Italy, Normandy and Germany. Over 500 Horsa gliders were supplied to the U.S. Army under reverse Lease/Lend for the invasion of Europe. It was fully described in the last issue of this Annual.

A civil conversion of the Oxford, known as the Consul, was designed, built and made available at the beginning of 1946. This aircraft is also offered as an ambulance.

The main project which Airspeed, Ltd., has in hand, however, is the construction of the Ambassador, a 28, 40 or 50-seat transcontinental airliner built to conform to the Brabazon II specification. A freighter version thereof named the Ayrshire, was projected but has since been cancelled.



The Airspeed A.S.57 Ambassador.

THE AIRSPEED A.S.57 AMBASSADOR.

The Ambassador is a twin-engined high-wing monoplane designed to supercede the interim airliners at present operating on the transcontinental air routes, and is built to Specification II drawn up by the Brabazon Committee for a medium-range airliner. The prototype was approaching completion at the time of writing.

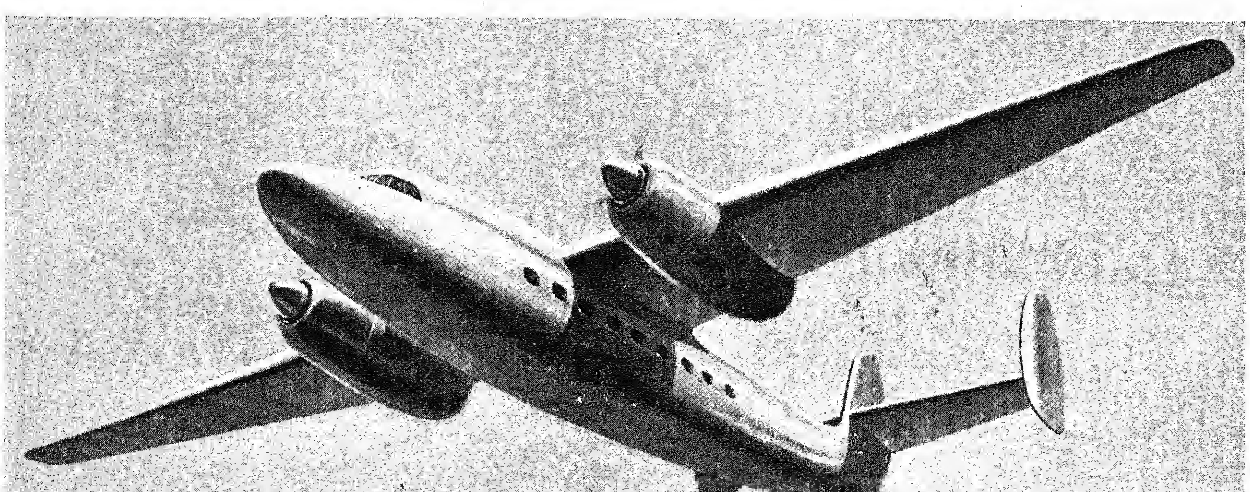
The Ambassador is to be produced in three versions with alternative seating capacities, the twenty-eight-passenger model being pressurized. A wide range of cruising speeds on 40% take-off power (175 to 285 m.p.h.=283 to 459 km.h.) is estimated, and the single-engine performance is expected to be considerably in excess of P.I.C.A.O. recommendations.

TYPE.—Twin-engined medium-range Airliner.

WINGS.—Cantilever high-wing monoplane. Laminar-flow aerofoil section NACA 652416 at root tapering to NACA 652414 at tip. High aspect ratio structure consisting of two inner sections carrying engine nacelles and attached to centre-section structure; two detachable outer wings attached by bolts, and detachable monocoque tips. Two spar structure with built-up braced chordwise ribs, closely-spaced Z-section extruded alloy spanwise stringers and heavy-gauge metal skin. Skin thickness varies from 14-gauge on top and bottom inboard portions to 16-gauge on top outer portions and 18-gauge on bottom outer portions. Thermal de-icing system. Hot air fed through controllable ducts along leading-edge flows chordwise in very close contact with upper and lower surfaces, leaving wing at trailing-edge over length of flaps. 400,000 B.T.U. unit. Dihedral (under surface) 1 degree 22 minutes; aspect ratio 11; gross wing area 1,200 sq. ft. (111.48 sq. m.). Metal-framed aerodynamically-balanced ailerons, each in three sections, with shrouded leading-edges and fabric covering. Aileron area (each wing) 37 sq. ft. (3.43 sq. m.). All-metal split trailing-edge flaps 25% of wing chord between ailerons and fuselage divided by nacelles. Electro-hydraulic operation. Maximum depression 50 degrees. Inner flap area (each) 26 sq. ft. (2.4 sq. m.); outer flap area (each) 56 sq. ft. (5.2 sq. m.).

FUSELAGE.—All-metal structure with cross-section of two intersecting circles. Structure consists of vertical frames and bulkheads, continuous double angle-section longitudinal stringers and flush-riveted Alclad skin. Heavy transversal frames at front and rear spar pick-up points. Maximum external width 11 ft. 5 in. (3.48 m.).

TAIL UNIT.—Cantilever structure with twin fins and rudders at extremities of tailplane, and third fin and rudder over fuselage centre-line. Horizontal aerofoil section EC 1540. Fin and rudder aerofoil section 0012.5. All-metal structure with metal skin over fins and tailplane, and fabric-covered rudders and elevators. Outer rudders have small horn-balanced portions at top and bottom which contain mass-balances. All fins detachable and outer fins interchangeable. Spring servo-tab on centre rudder and in each



A Drawing of the Airspeed A.S.57 Ambassador Airliner.

AIRSPEED—*continued.*

elevator. Tailplane span 28 ft. 0 in. (8.53 m.); incidence 0 degrees 35 minutes; total horizontal area 179 sq. ft. (16.6 sq. m.); centre fin area 40 sq. ft. (3.72 sq. m.); outer fin area (each) 59 sq. ft. (5.47 sq. m.).

Landing Gear.—Retractable tricycle type of Airspeed-Dowty design. Each main unit consists of twin Dunlop 37 in. (940 m/m.) landing wheels carried on common axle on single Dowty shock-absorber strut attached at 51% wing chord, which retracts forward into engine nacelle and is completely enclosed. Steerable nose unit comprises twin Dunlop 26.6 in. (675 m/m.) wheels on single leg which retracts rearward into fuselage. Track 27 ft. 6 in. (8.4 m.); wheel base 25 ft. 6 in. (7.8 m.). Complete gear raised by electro-hydraulic operation and lowered by gravity and air-drag forces. Each main wheel has pneumatically-operated brake. Emergency bumper wheel 16.2 in. (410 m/m.) diameter under rear fuselage.

Power Plant.—Two Bristol Centaurus 130 eighteen-cylinder two-row sleeve-valve radial air-cooled engines enclosed in Bristol-Airspeed low-drag cowlings and mounted as interchangeable power-eggs. Engines each rated at maximum take-off power of 2,610 h.p. at 2,700 r.p.m. at 4,250 ft. (1,855 m.) with 9½ lbs./sq. in. (0.67 kg./sq. c/m.) boost, or 3,000 h.p. at 800 ft. (245 m.) with M/W injection; METO power of 2,175 h.p. at 2,400 r.p.m. at 5,000 ft. (1,525 m.) with 6½ lbs./sq. in. (0.46 kg./sq. c/m.) boost, and a maximum weak mixture cruising power of 1,760 h.p. at 2,400 r.p.m. at 9,500 ft. (2,895 m.) with 3¼ lbs./sq. in. (0.23 kg./sq. c/m.) boost. D.H. four-blade full-feathering reversible-pitch airscrews, 16 ft. (4.88 m.) diameter. Bostick-sealed integral fuel tank in each wing between spars outboard of engine with capacity of 500 Imp. gallons (2,273 litres). Oil capacity 28 Imp. gallons (127 litres) per engine.

Accommodation.—Pressurized or non-pressurized accommodation. Crew compartment forward with pilot (on port) and co-pilot side-by-side with dual controls. Wireless-operator immediately behind pilot, with radio equipment on starboard. Crew entry door forward on starboard side. Main passenger accommodation is 52 ft. 6 in. (16 m.) long and has unobstructed space from bulkhead aft of crew compartment to rear bulkhead. Lay-out according to operators' requirements. Alternative standard arrangements provide for 28 (pressurized cabin), 40 or 50 passengers. Maximum cabin width 10 ft. 6 in. (3.2 m.). Plywood floor. Main entry door on port side aft of cabin 3 ft. 6 in. (1.07 m.) from ground. Freight loading door aft on starboard side. Twenty-eight-passenger version arranged as follows: Main cabin 28 ft. 4 in. long × 10 ft. 6 in. wide × 6 ft. 4½ in. high (8.6 m. × 3.2 m. × 1.9 m.) has volume of 1,830 cub. ft. (51.8 cub. m.); two toilet compartments each of 116 cub. ft. (3.3 cub. m.) capacity, and cloakroom of 45 cub. ft. (1,27 cub. m.) capacity at rear. Baggage compartments in nose (15 cub. ft.=0.42 cub. m.) and aft (100 cub. ft.=2.83 cub. m.). Luggage compartment (252 cub. ft.=7.1 cub. m.) on port side between crew quarters and main cabin, and galley (300 cub. ft.= 8.5 cub. m.) on starboard.

Dimensions.—Span 115 ft. 0 in. (35 m.), Length 80 ft. 3 in. (24.45 m.), Height (on ground, over rudders) 18 ft. 9½ in. (5.7 m.).

Weights and Loadings (Designed—40-seat version).—Weight empty 30,755 lbs. (13,950 kg.), Disposable load 14,245 kg. (6,460 kg.), Weight loaded 45,000 lbs. (20,410 kg.), Wing loading 37.5 lbs./sq. ft. (183 kg./sq. m.), Power loading (take-off power) 8.6 lbs./h.p. (3.9 kg./h.p.).

Performance (Estimated).—Maximum cruising speed (40% take-off power) 285 m.p.h. (459 km.h.), Climb to 20,000 ft. (6,095 m.) 14½ minutes, Maximum rate of climb on one engine (fully loaded) 600 ft./min. (183 m./min.), Maximum range 2,000 miles (3,219 km.), Take-off distance to 50 ft. (15 m.) 800 yds. (732 m.).

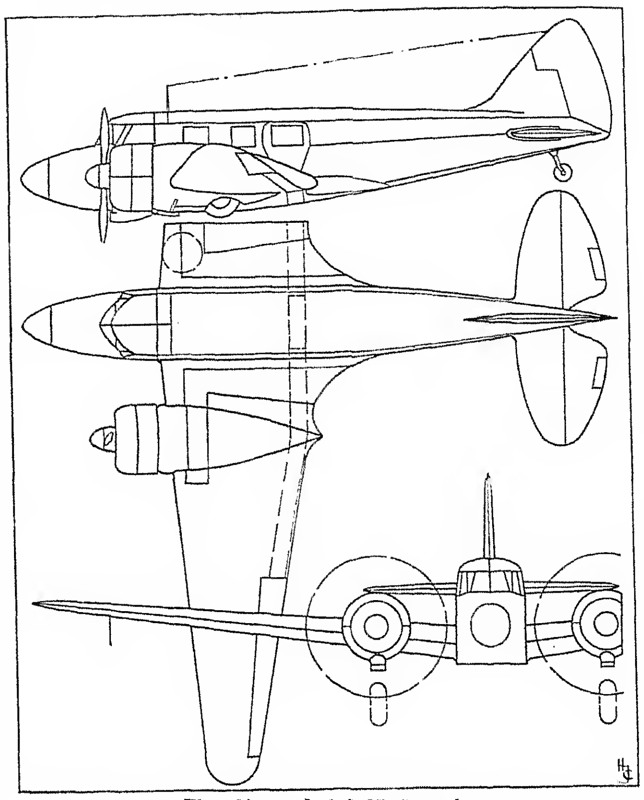
THE AIRSPEED A.S. 65 CONSUL.

The Consul is a civil conversion of the Oxford described hereafter, and is a light transport monoplane with accommodation for a pilot, radio-operator and five or six passengers, with baggage. Various cabin lay-outs are available to order, and the Consul can be equipped for ambulance duties.

Structurally the Consul is the same as the Oxford except for the following:—

Power Plant.—Two Armstrong Siddeley Cheetah X seven-cylinder radial air-cooled engines each rated at 395 h.p. at 2,425 r.p.m. at 4,300 ft. (1,310 m.) with 2.25 lbs./sq. in. (0.158 kg./sq. c/m.) boost.

Accommodation.—Crew of two consisting of pilot and co-pilot/radio-operator side-by-side with dual controls. Bulkhead installed aft of crew compartment, with double doors into main cabin. Main cabin is fully sound-proofed, heated and ventilated, and has two seats mounted on front spar, one on either side of fuselage; one seat on rear spar on starboard side, with provision for optional seat on port side, and double-seat aft of rear spar. Cabin floor between spars has been lowered to provide additional leg room. Rear bulkhead hinged on vertical centre-line to permit inspection of rear fuselage. Access door to main cabin on port side aft of trailing-edge. Hinged nose-cap replaces bomb-aiming window of Oxford and allows access to compartment with capacity for 150 lbs. (68 kg.) freight. Additional luggage space between rear seats and rear bulkhead.



The Airspeed A.S.65 Consul.

Equipment.—Standard Telephones S.T.R.11/16 (A.R.I.5206) or S.T.R.9 radio equipment installed in front fuselage floor ahead of dashboard. Provision for Decca Navigator.

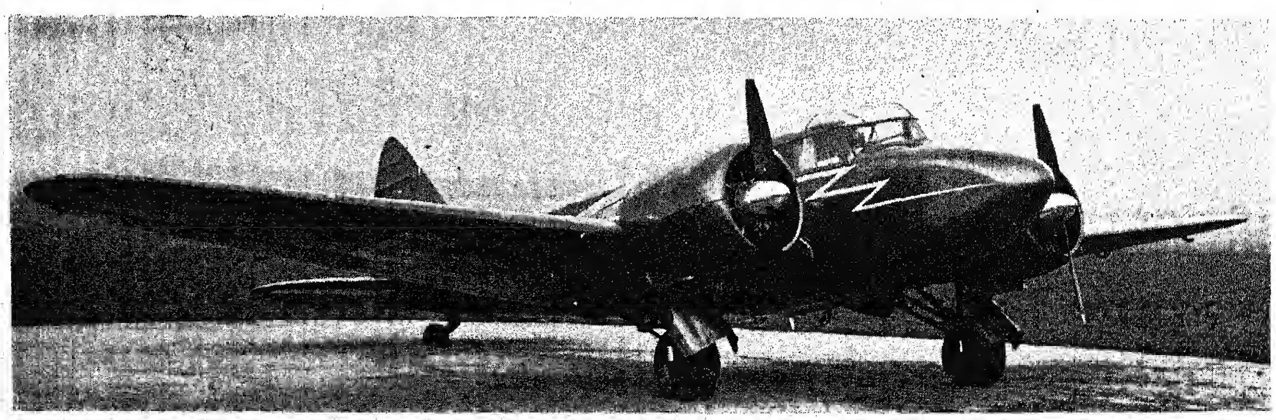
Dimensions.—Span 53 ft. 4 in. (16.25 m.), Length 35 ft. 4 in. (10.77 m.), Height 10 ft. 1½ in. (3.10 m.).

Weights and Loadings.—Weight empty 6,000 lbs. (2,722 kg.), Disposable load 2,250 lbs. (1,021 kg.), Maximum weight loaded 8,250 lbs. (3,742 kg.), Wing loading 23.1 lbs./sq. ft. (112.7 kg./sq. m.), Power loading 10.4 lbs./h.p. (4.7 kg./h.p.).

Performance.—Maximum speed at maximum power altitude 190 m.p.h. (306 km.h.) at 4,800 ft. (1,465 m.), Maximum weak mixture cruising speed 163 m.p.h. (262 km.h.), Rate of climb at sea level 1,070 ft./min. (326 m./min.), Climb to 5,000 ft. (1,525 m.) 4 minutes, Climb to 10,000 ft. (3,050 m.) 10 minutes, Maximum range 900 miles (1,448 km.), Take-off distance to 66 ft. (20 m.) in 5 m.p.h. (8 km.h.) wind, 575 yds. (526 m.), Landing run in still air 275 yds. (251 m.), Fuel consumption, less than 15 Imp. gallons (68 litres) per hour per engine.

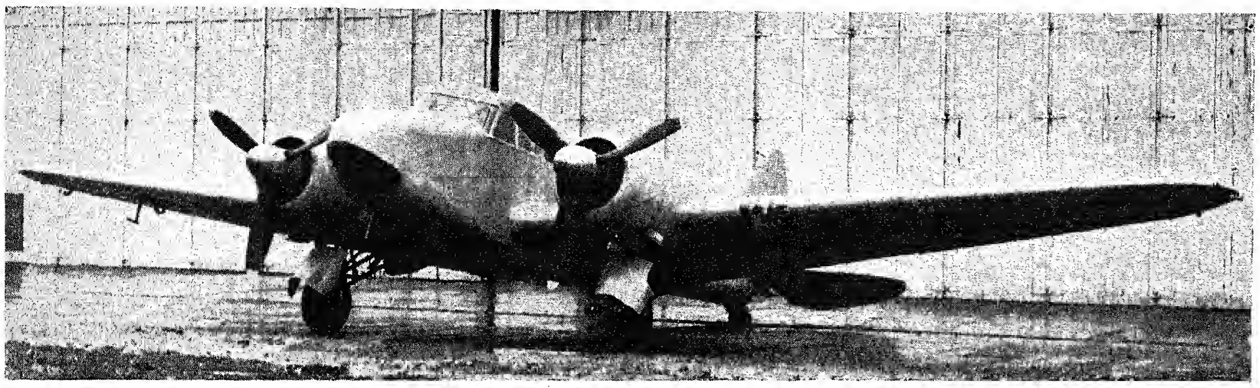
THE AIRSPEED A.S. 10 OXFORD.

The Oxford, built to conform to Specification T.23/36, was evolved from the Envoy civil transport monoplane of 1934. It first went into service with the Royal Air Force as a twin-engined advanced trainer in January, 1938. Altogether five marks of the Oxford were produced, but although certain examples of the later marks are still in service, the most commonly used version is the Mk. I with no gun turret, which is described hereafter. Details of the other versions were given in the last issue of "All the World's Aircraft."



The Airspeed A.S.65 Consul Light Transport Monoplane (Two 395 h.p. Armstrong Siddeley Cheetah X engines).

***AIRSPEED**—continued.*



An Airspeed Oxford which is being used as a flying test-bed for two 500 h.p. Alvis Leonides engines.

A total of about 9,000 Oxfords were built, 4,411 by Airspeed, Ltd. Other companies contributing to the total were the de Havilland Aircraft Co., Ltd., Percival Aircraft, Ltd. and the Standard Motor Co., Ltd.

The Oxford is used in service Flying Training Schools in the United Kingdom, Canada, Australia, New Zealand, Southern Rhodesia and the Middle East, and it is also employed on light transport and communication duties. A small number was made availablo under reverse Lend/Lease to the U.S.A.A.F. in Great Britain.

Type.—Twin-engined Advanced Trainer.

Wings.—Cantilever low-wing monoplane. Centre-section built separately from fuselage. Outer sections tapered in chord and thickness and attached to centre-section by four bolts and locking-nuts, one to each spar joint. Bolts pass through tapered high-tensile steel plugs at each end to take shear. Structure consists of two box-spars of spruce and birch three-ply. Former ribs of normal girder type constructed in three sections. Special system of interspar bracing consists of built-up diagonal struts. Plywood covering. Metal-framed Handley Page slotted ailerons with fabric covering. Split trailing-edge flaps of duralumin construction in five sections extending under fuselage. Hydraulic operation. Aspect ratio 8.15. Gross wing area 348 sq. ft. (32.33 sq. m.).

Fuselage.—Semi-monocoque wooden structure in two main sections. Front section is built as a unit and comprises pilot's cockpit and cabin. Rear section with integral fin.

Tail Unit.—Cantilever monoplane type. Wooden framework with wooden covering over tailplane and fin, and fabric-covered elevators and rudder. Balanced rudder hinged to fin only, with hinge-line inclined forward. Controllable trim-tabs in elevators.

Landing Gear.—Retractable two-wheel type. Main wheels each carried between pair of oleo shock-absorber legs which retract backwards into the engine nacelles, leaving a small portion of each wheel exposed. Twin doors enclose legs. Some aircraft have fairing plates in front of legs and wheels. Hydraulic operation. Dunlop low-pressure tyres and pneumatic wheel brakes. Non-retractable Dunlop tail-wheel.

Power Plant.—Two 355 h.p. Armstrong Siddeley Cheetah X seven-cylinder radial air-cooled engines mounted on welded steel-tube bearers and driving Fairey-Reid two-blade fixed-pitch metal airscrews. Two main fuel tanks in centre-section between spars, and two auxiliary tanks in outer wings interconnected with main tanks. Total capacity 156 Imp. gallons (710 litres). Combined oil tanks and coolers mounted behind engines. Total oil capacity 17 Imp. gallons (77 litres).

Accommodation.—Normal crew of three. Alternative stations for pilot, navigator/second pilot, bomb-aimer, wireless-operator and camera operator. Pilot's cockpit in nose on port, with seat for second pilot/navigator on starboard. Dual controls, second set removable to provide prone bombing position beside pilot. Bomb-aiming window in nose. Navigator (when carried) occupies second pilot's seat, which is moved back in line with chart table. Wireless-operator on seat on rear spar facing aft on starboard side.

Equipment.—Equipment can be installed to enable aircraft to be used for navigational training (including night-flying); W/T, D/F and S.B.A. training; bombing training; air photography and *ab initio* twin-engine pilot training (including night-flying and synthetic two-stage amber day/night training). Also available as an ambulance with accommodation for two stretchers.

Dimensions.—Span 53 ft. 4 in. (16.25 m.), Length 34 ft. 6 in. (10.5 m.), Height 11 ft. 1 in. (3.3 m.).

Weights and Loadings.—Weight empty 5,322 lbs. (2.412 kg.), Removable load varies according to function, Weight loaded 7,600 lbs. (3,450 kg.), Wing loading 21.8 lbs./sq. ft. (106.4 kg./sq. m.), Power loading 10.6 lbs./h.p. (4.8 kg./h.p.).

Performance.—Maximum speed 188 m.p.h. (301 km.h.), Stalling speed 64 m.p.h. (103 km.h.), Rate of climb at 6,300 ft. (1,920 m.) 960 ft./min. (293 m./min.), Climb to 10,000 ft. (3,050 m.) 12 minutes, Service ceiling 19,500 ft. (5,945 m.).

ARMSTRONG WHITWORTH.

SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT, LTD.

Head Office, Works and Aerodrome: Baginton, near Coventry.

Directors: Sir Frank Spencer Spriggs, Hon. F.R.Ae.S. (Chairman), T. O. M. Sopwith, C.B.E., F.R.Ae.S. and H. M. Woodhams, C.B.E., F.R.Ae.S.

Chief Designer: J. Lloyd.

Secretary: W. A. Blackler.

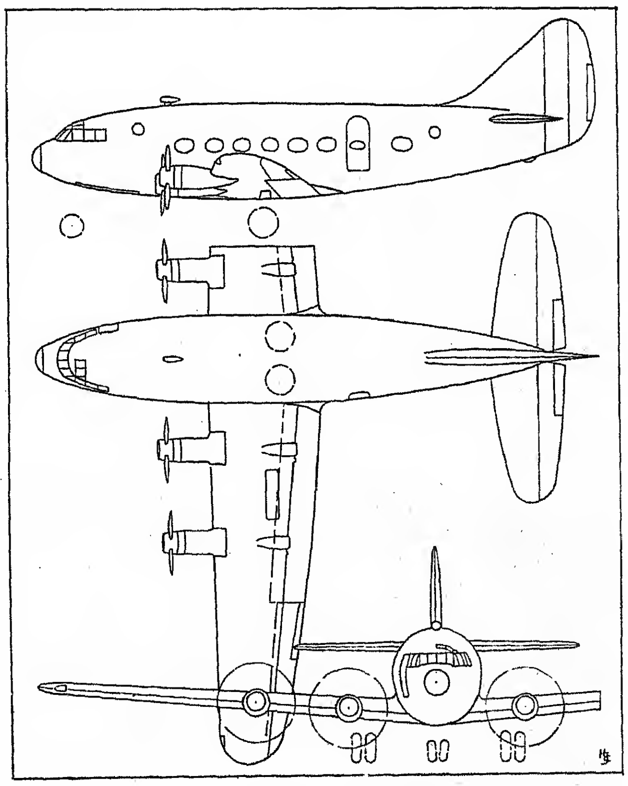
Sir W. G. Armstrong Whitworth Aircraft, Ltd., was formed in 1921. In 1935, the Hawker-Siddeley Aircraft Co., Ltd., was formed to amalgamate the interests of Hawker Aircraft Ltd. and the Armstrong Siddeley Development Co., Ltd., which latter company controlled Sir W. G. Armstrong Whitworth Aircraft, Ltd., Armstrong Siddeley Motors, Ltd., and A. V. Roe & Co., Ltd.

The Company were pioneers in the development of all-metal aircraft, and it is due to their initiative that the use of high-tensile steel became prominent.

In the pre-1939 era they developed, in addition to the military types then under construction—Siskin, Atlas, etc.—several series of commercial aircraft. These included the Argosy, Atalanta and Ensign classes, all of which gave long and reliable service on the air routes of Imperial Airways. Eight aircraft of the Ensign class were still owned by the British Overseas Airways Corporation on March 31, 1946.

Concurrently with the development of these types, the military series of Whitley and Albemarle were in being. The Whitley was the first heavy bomber in production and although it was withdrawn from production in 1942 it was still in service for glider towing and bomber training purposes when the war ended. In 1942, a series of Whitley aircraft was converted for use by British Airways as freight-carriers.

The Albemarle was the first British operational aeroplane to be fitted with a tricycle landing-gear. Originally designed as a light bomber-reconnaissance type, it was later converted for bomber-training, glider-towing, troop-carrying, and general transport purposes. As a paratroop carrier and glider-tug the Albemarle took part in the invasions of Sicily and Normandy.

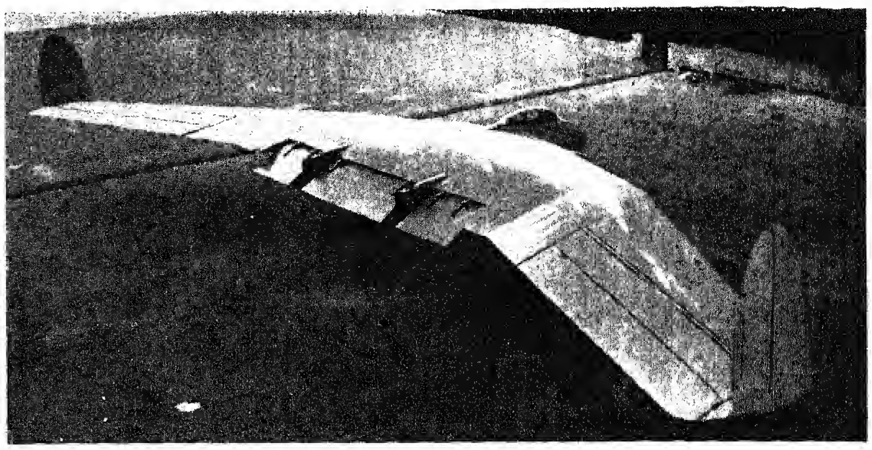


The Armstrong Whitworth A.W.55 Achilles.

ARMSTRONG WHITWORTH—*continued.*

The forward policy of the Company is based upon the development of the large type of aircraft, orthodox and unorthodox, for both civil and military purposes. The unorthodox include the A.W. 52 jet-propelled flying-wing and A.W.52G flying-wing glider.

The Company's latest development is the A.W. 55 Airliner, designed to comply with Specification IIB of the Brabazon Committee.



The Armstrong Whitworth A.W.52 Tail-less Monoplane (two Rolls-Royce Nene engines).

THE ARMSTRONG WHITWORTH A.W.55 ACHILLES.

The A.W. 55 is a low-wing monoplane designed to conform to the requirements of Specification II B of the Brabazon Committee. It is to be powered by four Armstrong Siddeley Mamba gas turbine engines each developing approximately 1,000 h.p. and driving four-blade tractor airscrews.

Normal seating capacity is for 24 passengers arranged in two rows of double seats on either side of a central aisle, with alternative accommodation for 30. The main passenger compartment is unobstructed by any bulkhead or other structure and the whole of the fuselage is pressurized for high-altitude flying. Freight compartments are placed at either end of the main accommodation.

An exceptional standard of safety is the first objective of the design and two special features are mainly devoted to this purpose. The landing gear travel is sufficient to absorb the shock of gliding unchecked on to the ground, as may sometimes happen in cases of low visibility. To check the swing should one engine fail at take-off the large single fin and rudder is divided into three parts by two vertical hinges. Only the aft portion is moved by the pilot and when this reaches its maximum angle hydraulic operation of the forward rudder is automatically brought into effect.

De-icing is by passing heated air through ducts within the wing.

DIMENSIONS.—Span 92 ft. 0 in. (28.04 m.), Wing area 840 sq. ft. (78 sq. m.).

WEIGHT AND LOADING (Designed).—Maximum weight loaded 35,000 lbs. (13,874 kg.), Wing loading 41.6 lbs./sq. ft. (203 kg./sq. m.).

PERFORMANCE (Estimated).—Cruising speed 276 m.p.h. (444 km.h.) at 20,000 ft. (6,095 m.), Still-air range at 20,000 ft. (6,095 m.) 1,352 miles (2,175 km.), Service ceiling on three engines 30,000 ft. (9,145 m.).

THE ARMSTRONG WHITWORTH A.W.52.

The A.W.52 is an all-wing twin-jet aircraft intended for research purposes, and is a larger powered version of the A.W.52G glider described later. It is an all-metal structure built to Specification E.9/44, and is powered by two Rolls-Royce Nene centrifugal-flow turbo-jet units mounted in the wings, one on each side of the central nacelle, with intakes in the wing leading-edge. There is capacity for 851 Imp. gallons (3,869 litres) of fuel.

The crew of two is accommodated in a pressurized cabin.

In general form the A.W.52 follows closely the glider. The wing has an aerofoil section of NPL.655-3-218 at the root, tapering to NPL.655-3-118 at the extremity of the centre-section and to NPL.645-3-015 at the tips The outer wings are sharply swept-back and tapered. A similar form of control system as is used on the glider is incorporated in the A.W.52.

At the time of writing test flights of the A.W.52 were pending.

DIMENSIONS.—Span 90 ft. (27.43 m.), Length 37 ft. 4 in. (11.37 m.),, Height 14 ft. 4 in. (4.37 m.), Wing area 1,314 sq. ft. (122.07 sq. m.).

WEIGHT AND LOADING (Designed).—Weight loaded 32,700 lbs. (14,833 kg.), Wing loading 24.8 lbs./sq. ft. (121 kg/sq. m.)

PERFORMANCE.—No data available.

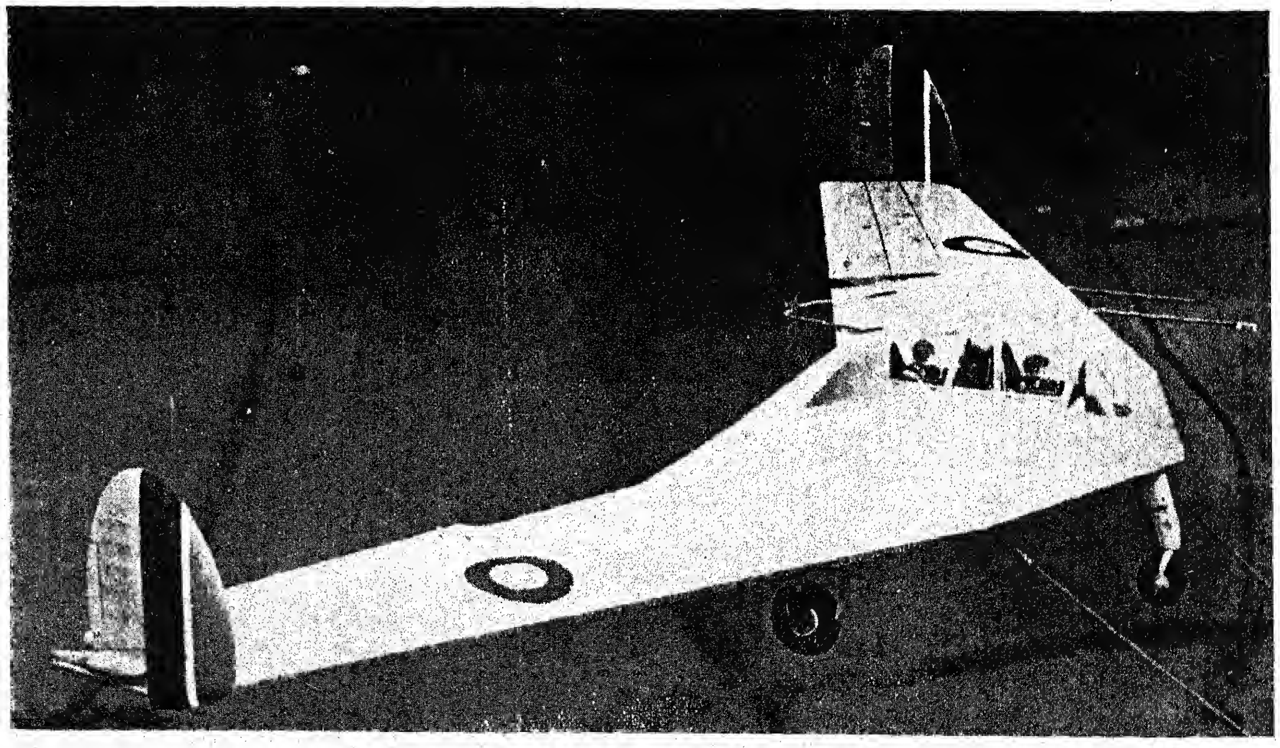
THE ARMSTRONG WHITWORTH A.W.52G GLIDER.

The A.W.52G is an experimental all-wing aircraft which was produced to provide aerodynamic data for projected powered designs of similar lay-out. Design work began in May, 1943, and in the following March construction was initiated. A motorless design was chosen for quickness of production, and on March 2, 1945, the A.W.52G was towed into the air on its first flight.

When released from 20,000 ft. (6,095 m.) the glide lasts for about 30 minutes, allowing sufficient time for observations to be made. Up to May, 1946, about 35 hours of towed and free flight had been made.

TYPE.—Experimental all-wing glider.

WINGS.—Composite cantilever wing which forms basic structure of



The Armstrong Whitworth A.W.52G Experimental Flying-Wing Glider.

ARMSTRONG WHITWORTH—continued.

aircraft. Aerofoil section NACA 653220. Constructed in three main sections consisting of centre-section with swept-back leading-edge and two swept-back and tapered outer wings attached by high tensile steel bolts. Single spruce and plywood box-spar swept-back from centre-line, with spruce webs, and spruce and plywood ribs. Covering of Plymax, which consists of $\frac{1}{16}$ in. (1.58 m/m.) plywood glued to 22 s.w.g. Alclad. Solid spruce leading-edge and trailing-edge, with stressed plywood D-section nose. Auxiliary swept-back spar in centre-section to carry nose-wheel loads. Incidence (root) 56 minutes; (tip) negative 2 degrees 19 minutes; dihedral (at 41% chord) 50 minutes 12 seconds; root chord 12 ft. $4\frac{1}{2}$ in. (3.76 m.). Gross wing area 443 sq. ft. (41.14 sq. m.). Longitudinal and lateral control is achieved with "controllers" or "elevons" which are hinged on each outer wing and serve as both elevators and ailerons. The controllers are hinged to movable surfaces known as "correctors" which provide fore-and-aft trim and are used to counteract the pitching movement caused by the lowering of the flap. Each corrector is balanced by a plate attached to its pivot-point and projecting forward into a pressure chamber into which ducts lead from the upper and lower surfaces of the wing. The controllers are provided with geared spring-tabs which are linked with the controllers themselves and the correctors. Controller area (each) 28.5 sq. ft. (2.63 sq. m.); controller movement (up) $25\frac{1}{4}$ degrees; (down) $22\frac{1}{2}$ degrees; corrector area (each) 18.8 sq. ft. (1.75 sq. m.). Single Fowler-type slotted flap on trailing-edge of centre-section. Flap span 15 ft. 4 in. (4.67 m.); flap area 57.5 sq. ft. (5.33 sq. m.); maximum flap depression 40 degrees. Retractable spoilers inboard of controllers interconnected with controllers and correctors. Flaps and corrector operated by hydraulic jacks, for which power is supplied by a compressed-air cylinder.

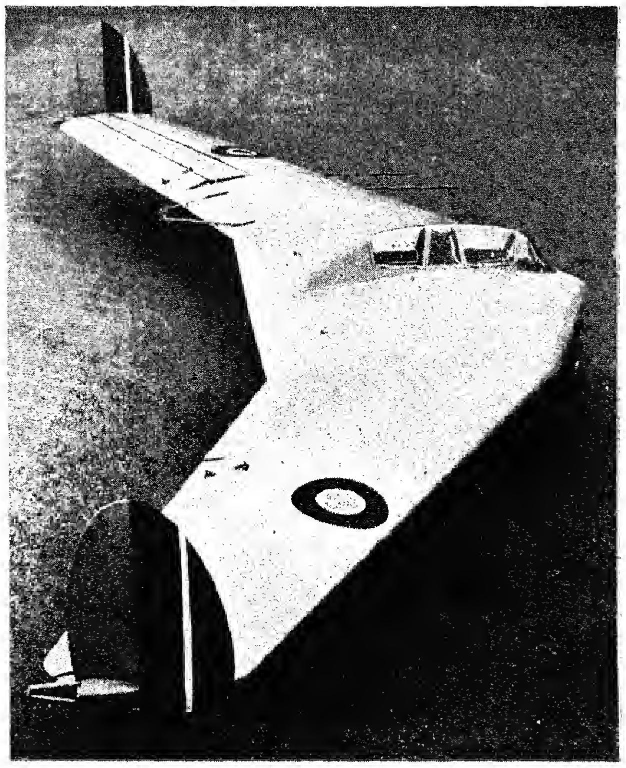
Fins and Rudders.—Twin elliptical fins and rudders mounted as endplates to wing for directional control. Wooden structures with pressure-sealed balanced rudders. Rudders differentially operated with outward movement of 30 degrees and inward movement of 10 degrees. Fin area (each) 11.1 sq. ft. (1.03 sq. m.); rudder area (each) 2.46 sq. ft. (0.227 sq. m.).

Landing Gear.—Fixed tricycle type. Each main wheel carried on Lockheed oleo shock-absorber leg attached to spar at extremities of centre-section. Dunlop 22.55 in. × 7.20 in. tyres and Dunlop brakes. Nose-wheel carried in fork on Lockheed oleo shock-absorber leg attached to front auxiliary spar. Marstrand anti-shimmy tyre. Track 13 ft. 9 in. (4.19 m.).

Accommodation.—Central nacelle built into wing structure with seats for two in tandem. Raised transparent cover has hinged portions for access.

Equipment.—Experimental equipment includes 16 m/m. photographic recorders mounted in wing centre-section. Wind-driven pumps with airscrews on main landing gear legs provide suction for boundary layer control to avoid tip stalling and stick force reversal effects. Anti-spin parachutes in wing-tip containers.

Dimensions.—Span 53 ft. 10 in. (16.40 m.), Length 19 ft. 4 in. (5.89 m.), Height 8 ft. 4 in. (2.54 m.).



The Armstrong Whitworth A.W.52G Experimental Flying-Wing Glider.

Weights and Loadings.—Weight empty 4,450 lbs. (2,017 kg.), Equipment 1,150 lbs. (522 kg.), Crew 400 lbs. (181 kg.), Weight loaded 6,000 lbs. (2,720 kg.), Wing loading 13.46 lbs./sq. ft. (65.7 kg./sq. m.).

Performance.—Maximum permissable speed 250 m.p.h. (402 km.h.), Landing speed 65 m.p.h. (105 km.h.).

AUSTER.

AUSTER AIRCRAFT, LTD.

Head Office and Works: Rearsby Aerodrome, Rearsby, Leicester.

Directors: P. Wykes (Chairman), F. Bates (Managing Director), A. L. Pickering and K. Sharp.

Chief Designer: S. H. Bostock.

Auster Aircraft, Ltd. is the successor to Taylorcraft Aeroplanes (England) Ltd., which was formed in 1939 to manufacture a cabin monoplane under licence from the Taylorcraft Aircraft Corporation of America. The Company assumed its present title on March 7, 1946, and no longer has any connection with the American firm.

The British Taylorcraft was produced in a number of different forms for the R.A.F. and the Army. The Auster I (Blackburn Cirrus-Minor engine), the Auster III (D.H. Gipsy-Major engine) and the Auster IV and V (130 h.p. Lycoming engine) were all used on active service. Particulars of each have been given in previous issues of this Annual. Throughout the War development of the design continued, and although the same basic welded steel-tube structure remained, considerable strengthening was achieved and the performance was improved. In the later models trailing-edge flaps were incorporated. During the War the Company built 1,604 Austers for the R.A.F. and the Army Air Corps—100 Mk. I; 2 Mk. II; 467 Mk. III; 255 Mk. IV and 780 Mk. V. In addition 6 Model H gliders were built.

A civilian version of the Mk. V has been produced and is known as the Auster V J/1 Autocrat. It is basically the same as the military Mk. V but has upholstered accommodation and other civilian refinements. By July, 1946, over 200 Autocrats had been built and delivered to customers in many countries. A two-seat version powered by a 75 h.p. Continental engine

The Auster J/2 Arrow Two-seat Cabin Monoplane (75 h.p. Continental engine).

***AUSTER**—continued.*

and known as the Arrow was undergoing flight trails at the time of writing, and a further version, the J/3 is Atom projected.

The Auster VI, powered by a 145 h.p. D.H. Gipsy-Major VII engine has superceded the Mks. IV and V.

THE AUSTER J/2 ARROW

The Arrow is a two-seat development of the Autocrat powered by a 75 h.p. Continental four-cylinder horizontally-opposed air-cooled engine, but is otherwise similar to the earlier aircraft. The cabin has side-by-side seating, and upward and rearward windows are incorporated. A small luggage rack is provided aft of the seats. No wing flaps are fitted, but other improvements are embodied.

Dimensions.—Span 36 ft. (11.0 m.), Length 22 ft. 5¾ in. (6.86 m.), Height 8 ft. 1 in. (2.46 m.), Wing area 185 sq. ft. (17.14 sq. m.).

Weights and Loadings.—Weight empty 912 lbs. (414 kg.), Weight loaded 1,450 lbs. (658 kg.), Wing loading 7.8 lbs./sq. ft. (38.1 kg./sq. m.), Power loading 19.3 lbs./h.p. (8.74 kg./h.p.).

Performance (Estimated).—Maximum speed 98 m.p.h. (158 km.h.). Cruising speed at 2,050 r.p.m. 85 m.p.h. (137 km.h.), Stalling speed 36 m.p.h. (58 km.h.), Rate of climb 430 ft./min. (131 m./min.), Service ceiling 8,000 ft. (2,440 m.), Still-air range 320 miles (518 km.), Take-off run in 5 m.p.h. (8 km.h.) wind 150 yds. (137 m.), Landing run 5 m.p.h. (8 km.h.) 80 yds. (73 m.), Economic cruising fuel consumption 4 Imp. gallons (18.2 litres) per hour.

THE AUSTER V SERIES J/1 AUTOCRAT.

Type.—Three-seat cabin monoplane.

Wings.—Strut-braced high-wing monoplane. Wing built in two sections attached to top of fuselage and braced to lower longerons by streamlined steel-tube V-struts on each side. Structure consists of laminated spruce spars, ribs of drawn-section Birmabrite steel, drag struts, steel tie-rod internal bracing, metal leading-edge and an overall fabric covering. Incidence (root) 3¾ degrees; (tip) 2½ degrees; dihedral 1 degree; chord 5 ft. 3 in. (1.60 m.); nett wing area 169 sq. ft. (15.69 sq. m.); gross wing area 185 sq. ft. (17.14 sq. m.). Ailerons have wooden spars, light alloy nose and ribs and fabric covering. Total aileron area 18 sq. ft. (1.66 sq. m.). Manually-operated split trailing-edge flaps between ailerons and fuselage have steel torsion shaft and light alloy skin. Total flap area 16 sq. ft. (1.47 sq. m.).

Fuselage.—Rectangular-section welded steel-tube structure with wooden stringers and fabric covering.

Tail Unit.—Braced monoplane type. Welded steel-tube framework with fabric covering. Fixed tailplane. Rudder has trim-tab adjustable on ground. Controllable trim-tab in port elevator. External tie-rod bracing. Tailplane span 10 ft. (3.05 m.). Gross tailplane area 24.72 sq. ft. (2.28 sq. m.); fin area 5 sq. ft. (0.37 sq. m.); rudder area 7.25 sq. ft. (0.67 sq. m.).

Landing Gear.—Fixed two-wheel split-axle type. Two faired steel-stube side vees with half-axles sprung under centre-line of fuselage by rubber-cord shock-absorbers. Dunlop wheels and Bendix brakes. Track 6 ft. 0 in. (1.83 m.). Full-castering tail-wheel on leaf-spring with solid rubber tyre.

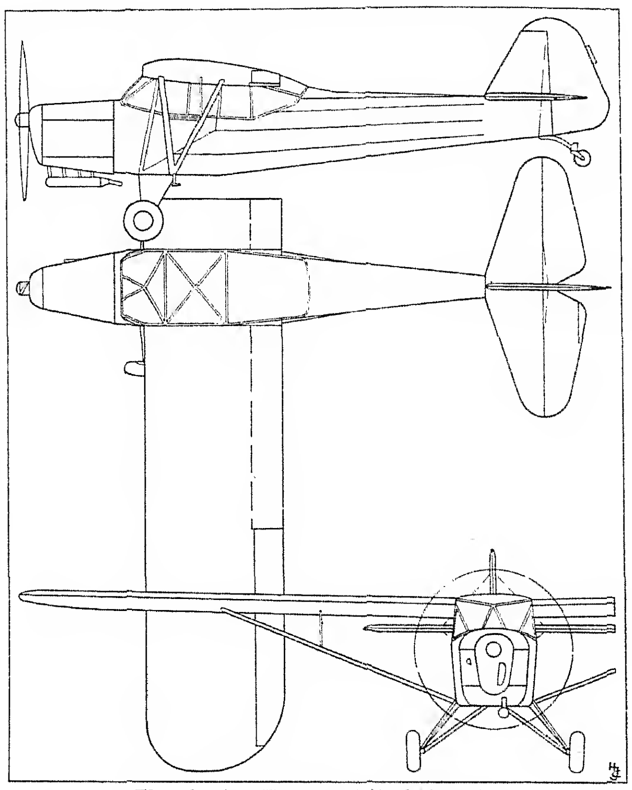
Power Plant.—One Blackburn Cirrus-Minor Series II four-cylinder in-line inverted air-cooled direct-drive engine rated at 90 h.p. at 2,300 r.p.m. and with a maximum output of 100 h.p. at 2,600 r.p.m. Engine mounted on welded steel-tube bearer. Detachable side panels. Silencer and electric starter optional. Weybridge wooden or Fairey-Reed metal airscrew 6 ft. 0 in. (1.83 m.) diameter. Fuel tank between engine and dashboard with capacity of 15 Imp. gallons (68 litres). Auxiliary fuel tank of 13¾ Imp. gallons (62.5 litres) capacity may be carried under fuselage. Oil tank of 2 Imp. gallons (9 litres) capacity aft of engine.

Accommodation.—Enclosed cabin seating two side-by-side with dual controls, and one aft on starboard side facing to port. Backs of front seats hinge forward for access to rear. One-piece moulded Perspex windshield, and moulded cabin roof. Luggage space aft of rear seat with allowance of 400 lbs. (181 kg.). Access door on each side with sliding windows.

Dimensions.—Span 36 ft. 0 in. (11.0 m.), Length 23 ft. 5 in. (7.14 m.), Height (tail down, airscrew horizontal) 6 ft. 6 in. (1.98 m.).

Weights and Loadings.—Weight empty 1,052 lbs. (477 kg.), Fuel and oil 128 lbs. (58 kg.), Equipment 62 lbs. (28 kg.), Pilot, two passengers and luggage 608 lbs. (277 kg.), Weight loaded 1,850 lbs. (840 kg.), Wing loading (fully loaded) 10 lbs./sq. ft. (49 kg./sq. m.), Power loading (fully loaded, take-off power) 18.5 lbs./h.p. (8.5 kg./h.p.).

Performance.—Maximum speed 120 m.p.h. (193 km.h.), Cruising speed 100 m.p.h. (161 km.h.), Stalling speed (with two up and flaps down) 30 m.p.h. (57 km.h.), Rate of climb (at 1,700 lbs.=801 kg.) 500 ft./min. (180 m./min.), Ceiling 15,000 ft. (4,750 m.), Still-air range 220 miles (354 km.), Still-air range with long-range tank 500 miles (805 km.), Take-off run in 5 m.p.h. (8 km.h.) wind 250 yds. (228 m.), Landing run in 5 m.p.h. (8 km.h.) wind 99 yds. (90 m.), Fuel consumption at 2,300 r.p.m. 5.5 Imp. gallons (24.5 litres) per hr., Fuel consumption at 2,150 r.p.m. 4.75 Imp. gallons (20 litres) per hr.



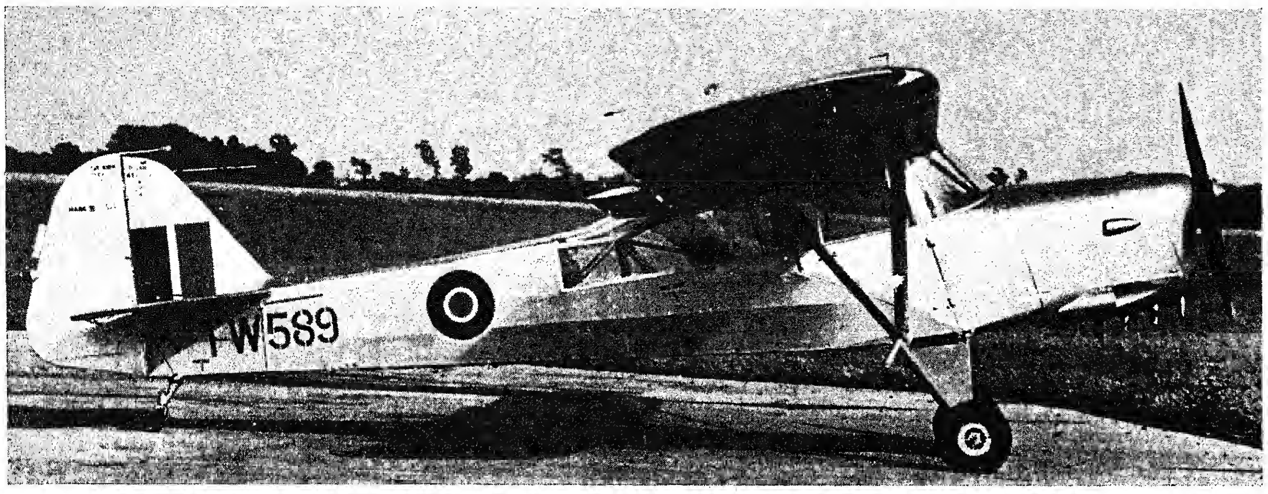
The Auster V Series J/1 Autocrat.

THE AUSTER VI.

The Auster VI is a post-war type which has superceded the previous military Austers. The fuselage structure has been considerably strengthened and the loaded weight has been increased. Specially designed all-metal external aerofoil flaps are fitted behind the trailing-edge of the wings, which have also been strengthened to accommodate two 11.5 Imp. gallon (52.25 litre) fuel tanks giving a total capacity of 23 Imp. gallons (104.5 litres). The Mk. VI is a two-seat aircraft with the radio receiver/transmitter beside the pilot's seat, which is adjustable for height. The rear seat for the observer is on a swivel base. Improved one-piece moulded Perspex windscreen and roof giving all-round visibility are incorporated. The landing-gear legs have been lengthened to allow sufficient clearance for the larger airscrew required for the 145 h.p. D.H. Gipsy Major VII four-cylinder in-line inverted air-cooled engine which is now installed.

The Auster J/1 Autocrat Three-seat Cabin Monoplane (100 h.p. Blackburn Cirrus-Minor II engine).

***AUSTER**—continued.*



The Auster VI Light Liaison and Observation Monoplane (145 h.p. D.H. Gipsy-Major VII engine).

Dimensions.—Span 36 ft. 0 in. (11.0 m.), Length 23 ft. 9 in. (7.23 m.), Height 8 ft. 4½ in. (2.55 m.), Wing area (excluding flaps) 184 sq. ft. (17.1 sq. m.).

Weights and Loadings.—Weight empty 1,413 lbs. (641 kg.), Maximum permissable loaded weight 2,160 lbs. (980 kg.), Wing loading 11.7 lbs./sq. ft. (57.12 kg./sq. m.), Power loading 14.8 lbs./h.p. (6.7 kg./h.p.).

Performance.—Maximum speed 124 m.p.h. (200 km.h.) at 1,000 ft. (305 m.). Cruising speed 108 m.p.h. (174 km.h.), Landing speed (with flaps) 32 m.p.h. (51 km.h.), Initial rate of climb (at 1,900 lbs. =862 kg.) 810 ft./min. (247 m./min.), Service ceiling 14,000 ft. (4,265 m.).

AVRO.

A. V. ROE & CO., LTD.

Head Office: Greengate, Middleton, Manchester.

London Office: 1, West Halkin Street, Belgrave Square, W.1.

Works: Newton Heath, Manchester, 10, and Ivy Works, Failsworth, Lancashire.

Directors: Sir Frank Spencer Spriggs, Hon. F.R.Ae.S. (Chairman), T. O. M. Sopwith, C.B.E., F.R.Ae.S., Sir Roy Dobson, C.B.E. (Managing), C. E. Fielding and Roy Chadwick, C.B.E. (Chief Designer).

A. V. Roe & Co. was formed in 1909, when the firm advertised itself as constructors of aeroplanes and accessories, and was probably the first firm in Great Britain to do so. The limited company was formed in January, 1913. On the amalgamation of the Hawker and Siddeley interests in 1935, the Avro Company, which formerly was a member of the Siddeley group, became a member of the group of companies controlled by the Hawker Siddeley Aircraft Co., Ltd.

During the War the Avro Company produced the Manchester, Lancaster and Lincoln heavy bombers, and the York and Lancastrian four-engined military and civil transport monoplanes, while the Anson, originally produced in 1935 as a general reconnaissance monoplane, continued to be produced for various training and communication duties.

Since the War the Company has completed the Tudor I and II four-engined airliners, which are alike except that the latter has a larger fuselage to accommodate more passengers. Both are fully pressurized and have been ordered for the British Overseas Airways Corporation and other air-lines. Descriptions of both of these aircraft follow.

The York, Lancastrian and Avro XIX, the commercial development of the Anson, are all in wide-spread military and civilian use, and the Lancaster and Lincoln still form an important part of R.A.F. equipment.

A special Lancastrian has been fitted with two Rolls-Royce Nene turbo-jet units in place of the two outboard Merlins, and in November, 1946, this aircraft completed a flight from the London Airport to Paris in 50 minutes. A Tudor II is being fitted experimentally with four Rolls-Royce Nene turbo-jet engines.

Both the Lincoln and Tudor II are being built in Australia for the R.A.A.F., the latter as a military transport.

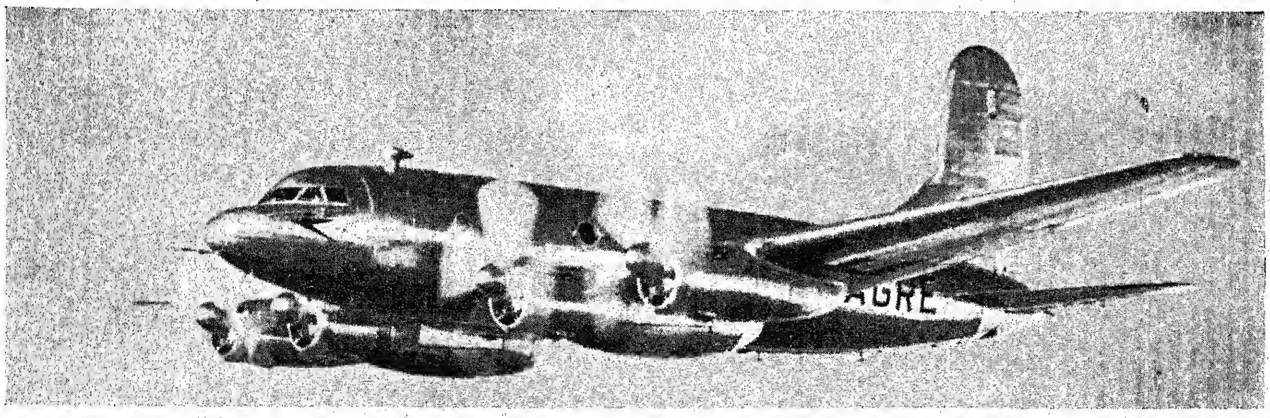
THE AVRO 688 TUDOR I (AVRO XX).

Type.—Four-engined Long-range Airliner.

Wings.—Cantilever low-wing monoplane. Aerofoil section (root) NACA 23018. All-metal two-spar structure consisting of centre-section carrying inner engine nacelles; two inner sections carrying outer engine nacelles, and two outer sections. I-section spars have extruded alloy booms with web plates and strengthening angles. Owing to pressurization only the spar booms pass through fuselage in rubber-sealed shrouds, the webs terminating at the fuselage outer skin, with separate webs inside fuselage. Pressed alloy chordwise ribs, with heavy cast alloy Warren-girder ribs at engine and landing-gear pick-up points. Longitudinal stringers in portion of wing aft of rear spar. Stressed light alloy skin riveted on. Root chord 16 ft. 0 in. (4.88 m.); incidence 4 degrees; dihedral (top front spar) 2 degrees 4 minutes; dihedral (rear spar datum) 4 degrees; aspect ratio 10.13; sweepback at front spar 6 degrees, 18 minutes. Gross wing area 1,421 sq. ft. (132 sq. m.). All-metal ailerons hinged by external brackets on inner and outer wing sections. Controllable trim and balance tabs in each. Hydraulically-operated split trailing-edge flaps on centre-section and inner wings in three sections each side. All-metal construction.

Fuselage.—All-metal semi-monocoque structure of circular cross-section. Structure consists of vertical bulkheads and channel-section frames, T-section and top-hat section longitudinal stringers to which riveted outer skin is bolted. Above the floor an inner skin is riveted to the frames, with kapok-filling between the two skins. All fuselage joints sealed with coating of bitumastic emulsion. Maximum fuselage diameter 10 ft. (3.05 m.).

Tail Unit.—Cantilever monoplane type. Fin and rudder aerofoil section NACA 0012. All-metal structure with dorsal fin integral with fuselage. Main fin built separately. All-metal two-spar tailplane in two sections joined on fuselage centre-line. Mass-balanced metal-covered control surfaces with controllable trim and servo-tabs in each. Elevators have tubular spar and pressed chordwise ribs. Tailplane span 43 ft. 0 in. (13.10 m.).



The Avro Tudor I Airliner (four 1,770 h.p. Rolls-Royce Merlin 600 engines).

AVRO—*continued.*

Landing Gear.—Retractable two-wheel type, similar to Lancaster. Each main wheel carried between pair of Dowty A916Y oleo shock-absorber legs with diagonal cross-bracing and rear bracing struts, retracts rearwards into inner engine nacelles and is enclosed by twin doors. Hydraulic operation. Dunlop AH 8268 wheels, with 64 in. × 22.5-26 in. (1,626 m/m. × 571-660 m/m.) tyres ; tyre pressure 62 lbs./sq. in. (4.36 kg./sq. c/m.). Track 23 ft. 9 in. (7.24 m.). Twin tail-wheels carried on Dowty liquid-spring unit with Dowty oleo leg retract rearwards into fuselage and are enclosed by twin doors. Dunlop wheels and tyres ; tyre pressure 69 lbs./sq. in. (4.85 kg./sq. c/m.).

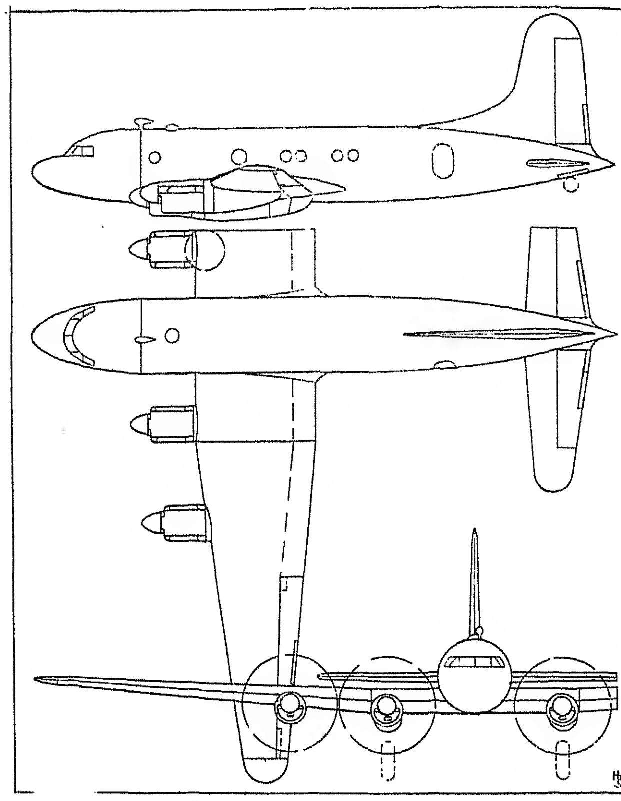
Power Plant.—Four Rolls-Royce Merlin 600 twelve-cylinder vee liquid-cooled engines each rated at 1,770 h.p. at 3,000 r.p.m. at 4,000 ft. (1,220 m.) and enclosed in circular-section self-contained and quickly-detachable nacelles. Rotol four-blade constant-speed full-feathering airscrews, 13 ft. (3.96 m.) diameter. Fuel capacity 3,300 Imp. gallons (15,011 litres) in eight Marston crash-proof collapsible bag-type cells situated between wing-spars, one on each side of fuselage and three in inner section of each outer wing.

Accommodation.—Fuselage pressurized throughout length. Crew of five consisting of pilot and co-pilot side-by-side with dual controls ; flight engineer aft of co-pilot ; wireless-operator aft of pilot, and navigator aft of wireless-operator. Crew compartment has volume of 646 cub. ft. (18.3 cub. m.). Bulkhead at front spar separates crew quarters from main cabin. Main cabin has volume of 1,161 cub. ft. (32.8 cub. m.) and terminates aft of wing trailing-edge. Alternative arrangements provide accommodation for 12 day-and-night passengers (*de Luxe* version) or 24 by day and 12 by night (Standard version). Cabin divided into sub-compartments each seating four or eight passengers by day ; each pair of seats (in *de Luxe* version) convertible into upper and lower bunks. Aft of main cabin are ladies dressing room (on starboard) with volume of 119 cub. ft. (3.4 cub. m.) ; men's dressing room (or port) with volume of 94.5 cub. ft. (2.7 cub. m.) ; two toilet compartments, one on starboard of 44 cub. ft. (1.2 cub. m.) and one on port of 44.5 cub. ft. (1.3 cub. m.) capacity ; wardrobe (on port) of 32 cub. ft. (0.9 cub. m.) capacity. Baggage compartment on starboard side opposite entry door with volume of 115 cub. ft. (3.3 cub. m.). Other baggage rooms in crew compartment ; one on port with volume of 87 cub. ft. (2.5 cub. m.), and one on starboard of 171 cub. ft. (4.8 cub. m.) capacity. Rear section of fuselage ahead of tail-unit arranged as kitchen with volume of 209 cub. ft. (5.9 cub. m.), and seat for steward. Main entrance door on port side of fuselage is sealed by automatically inflatable rubber tubing fed from pressurization system. Six emergency hatches similarly sealed. Pressure system housed partly in centre-section leading-edge and partly below fuselage floor. Two Marshall-Roots blowers driven off inboard engines. Air enters intakes in the wing leading-edge, passes through filters to blowers, intercooler and silencer before being fed to a non-return valve which is controllable to govern the amount of air admitted to the cabin. Air then passes through heaters and discharged into cabin through vents at floor level and louvres above windows.

Equipment.—T.K.S. de-icing on wings and tail-unit. Emergency oxygen bottles in crew compartment. Dinghies in port and starboard wing roots aft of inner engine nacelles. Full radio and radar equipment.

Dimensions.—Span 120 ft. 0 in. (36.6 m.), Length 79 ft. 6 in. (24.2 m.).

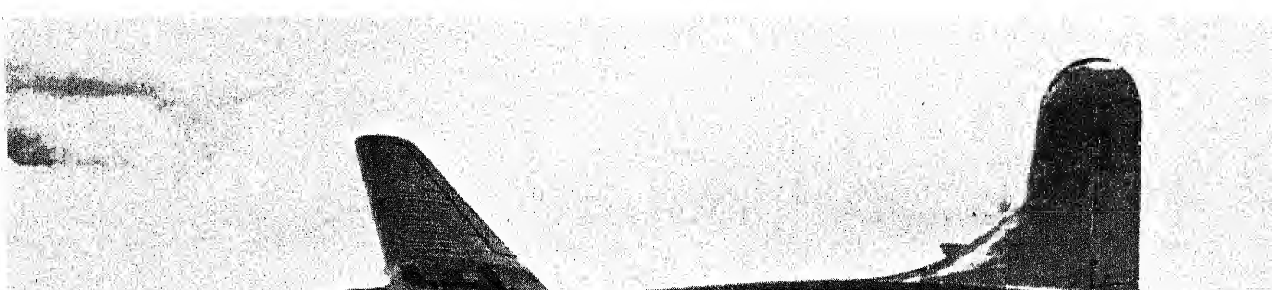
Weights and Loadings (*de Luxe* version).—Weight empty (without equipment) 39,360 lbs. (17,854 kg.), Weight empty (with all operational equipment) 47,977 lbs. (21,762 kg.), Crew (four and stewardess) 840 lbs. (381 kg.), Crew's baggage (five at 30 lbs. = 13.6 kg.) 150 lbs. (68 kg.), Fuel (3,300 Imp gallons = 15,011 litres) 23,760 lbs. (10,777 kg.), Oil (143 Imp. gallons = 650 litres) 1,287



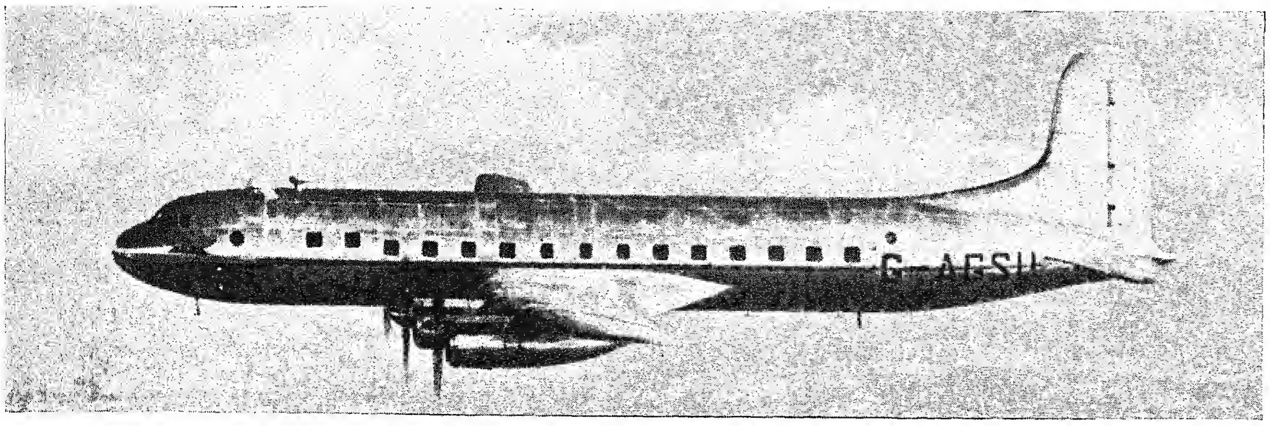
The Avro Tudor I Airliner.

lbs. (584 kg.), Passengers (12 at 170 lbs. = 77 kg.) 2,040 lbs. (925 kg.), Passengers' baggage (12 at 50 lbs. = 27 kg.) 600 lbs. (272 kg.), Food 100 lbs. (45 kg.), Mail or freight 3,246 lbs. (1,473 kg.), Weight loaded 80,000 lbs. (36,287 kg.), Wing loading 56.2 lbs./sq. ft. (274.37 kg./sq m.)., Power loading 11.15 lbs./h.p. (5.04 kg./h.p.).

Weights and Loadings (24-passenger version).—Weight empty (without equipment) 39,360 lbs. (17,854 kg.), Weight empty (with all operational equipment) 48,217 lbs. (21,871 kg.), Crew (four and stewardess) 840 lbs. (381 kg.), Crew's baggage (five at 30 lbs. = 13.6 kg.) 150 lbs. (68 kg.), Fuel (3,300 Imp. gallons = 15,011 litres 23,760 lbs. (10,777 kg.), Oil (143 Imp. gallons = 650 litres) 1,287 lbs. (584 kg.), Passengers (20 at 170 lbs. = 77 kg.) 4,080 lbs. (1,851 kg.), Passengers' baggage (24 at 50 lbs. = 27 kg.) 2,100 lbs. (544 kg.), Food 100 lbs. (45 kg.), Mail or freight 366 lbs. (166 kg.), Weight loaded 80,000 lbs. (36,287 kg.), Wing and power loadings, as *de Luxe* version.



The Avro Tudor I Long-range Airliner (four 1,770 h.p. Rolls-Royce Merlin 600 engines).



The Avro Tudor II Airliner (four 1,740 h.p. Rolls-Royce Merlin 621 engines).

WEIGHTS AND LOADINGS (32-passenger version).—Weight empty (without equipment) 39,700 lbs. (18,008 kg.). Weight empty (with all operational equipment) 49,225 lbs. (22,328 kg.). Crew (4 and 2 stewardesses) 1,000 lbs. (454 kg.). Crew's baggage 180 lbs. (82 kg.). Fuel (2,890 Imp. gallons = 13,144 litres) 20,800 lbs. (9,435 kg.), Oil (119 Imp. gallons = 541 litres) 1,072 lbs. (486 kg.), Passengers (32 at 170 lbs. = 77 kg.) 5,440 lbs. (2,467 kg.), Passengers' baggage (32 at 50 lbs. = 27 kg.) 1,600 lbs. (726 kg.), Food and drink 133 lbs. (60 kg.), Mail or freight 550 lbs. (249 kg.), Weight loaded 80,000 lbs. (36,287 kg.), Loadings as *de Luxe* version.

PERFORMANCE (At 78,000 lbs. = 35,381 kg.).—Maximum speed 346 m.p.h. (557 km.h.) at 20,500 ft. (6,250 m.), Cruising speed 300 m.p.h. (483 km.h.) at 22,500 ft. (6,860 m.), Rate of climb 880 ft./min. (268 m./min.), service ceiling 28,800 ft. (8,780 m.), Three-engine service ceiling 22,700 ft. (6,920 m.), Range (*de Luxe* version with 5,987 lbs. = 2,713 kg. payload) 3,700 miles (5,954 km.), (24-passenger version with 5,746 lbs. = 2,604 kg. payload) 3,700 miles (5,954 km.), (32-passenger version with 7,723 lbs. = 3,503 kg. payload) 3,200 miles (5,150 km.), Take-off distance to 50 ft. (15 m.) 1,500 yds. (1,372 m.).

THE AVRO 689 TUDOR II (AVRO XXI).

The Tudor II is a development of the Tudor I, and differs from it mainly by having a longer fuselage. Structurally the two types are similar, employing the same wings, engine mountings and landing gear. The tail areas of the Tudor II are slightly larger than those of the Tudor I.

The fuselage of the Tudor II is of circular cross-section and fully pressurized, and is constructed in five main sections. These consist of the nose-piece; front centre-section; rear centre-section; rear fuselage and tail-end. Each is composed of aluminium-alloy vertical intercostal frames, top-hat section longitudinal stringers and double Alclad metal sheet fixed by mushroom-head rivets, with kapok filling between the two skins. The fuselage diameter is 11 ft. (3.35 m.), an increase of 1 ft. (0.305 m.) over that of the Tudor I.

The cabin is tested to a pressure of 11 lbs./sq. in. (0.77 kg./sq. c/m.) and at 25,000 ft. (7,620 m.) a cabin atmosphere of 8,000 ft. (2,440 m.) is maintained.

The Tudor II also differs from the earlier mark in the following respects :—

POWER PLANT.—Four Rolls-Royce Merlin 621 twelve-cylinder vee liquid-cooled engines each rated at 1,740 h.p. enclosed in cylindrical nacelles and driving Rotol D24/445/1 four-blade constant-speed airscrews, 13 ft. (3.96 m.) diameter. Fuel tanks as Tudor I.

ACCOMMODATION.—Fully pressurized cabin as on Tudor I. Crew of six comprising pilot (on port) and co-pilot side-by-side with dual controls; flight engineer aft of co-pilot; navigator aft of pilot; radio-operator aft of navigator, and steward. Aft of crew compartment is galley (on port) and (on starboard) mail and freight compartment of 175 cub. ft. (16.25 cub. m.) capacity, diplomatic mail compartment, and crew's rest station. Two 50 cub. ft. (4.64 cub. m.) baggage holds under floor. Main passenger cabin with capacity of 4,020 cub. ft. (373.5 cub. m.) follows and extends as far as dressing-rooms at rear. In *de Luxe* version there is accommodation for 40 passengers arranged in double seats on the starboard side and single seats on port and in lounge at rear. Seats convertible into 22 berths; four seats provide a lower berth, and upper berth folds down from wall of cabin. Alternative versions provide accommodation for 40 day passengers and 60 day passengers. At rear of passenger cabin are a cloakroom, women's dressing-room and toilet; men's dressing-room and toilet and baggage compartment of 110 cub. ft. (10.22 cub. m.) capacity. Additional baggage hold under floor at rear of cabin with capacity of 75 cub. ft. (6.96 cub. m.) each side.

DIMENSIONS.—Span 120 ft. 0 in. (26.6 in.), Length 105 ft. 7 in. (32.18 m.), Height 24 ft. 3 in. (7.39 m.).

WEIGHTS AND LOADINGS (*de Luxe* version).—Weight empty (without equipment) 41,770 lbs. (18,947 kg.), Weight empty (with full equipment) 53,318 lbs. (24,185 kg.), Crew (6) 1,000 lbs. (454 kg.), Crew's baggage 180 lbs. (83 kg.), Fuel (2,111 Imp. gallons = 9,703 litres) 15,199 lbs. (6,892 kg.), Oil (88 Imp. gallons = 400 litres) 792 lbs. (360 kg.), Passengers (40) 6,800 lbs. (3,084 kg.), Passengers' baggage 2,000 lbs. (907 kg.), Food and drink 161 lb. (73 kg.), Mail or freight 550 lbs. (249 kg.), Weight loaded 80,000 lbs. (36,287 kg.), Wing loading 56.29 lbs./sq. ft. (274.8 kg./sq. m.), Power loading 11.5 lbs./h.p. (5.2 kg./h.p.).

WEIGHTS AND LOADINGS (40 day-passenger version).—Weight empty (without equipment) 41,770 lbs. (18,947 kg.), Weight empty (with full equipment) 51,718 lbs. (23,458 kg.), Crew (6) 1,000 lbs. (454 kg.), Crew's baggage 180 lbs. (83 kg.), Fuel (2,340 Imp. gallons = 10,644 litres) 16,848 lbs. (7,642 kg.), Oil (100 Imp. gallons = 455 litres) 900 lbs. (408 kg.), Passengers (40) 6,800 lbs. (3,084 kg.), Passengers' baggage 2,000 lbs. (907 kg.), Food and drink 164 lbs. (74 kg.), Mail or freight 390 lbs. (177 kg.), Weight loaded 80,000 lbs. (36,287 kg.), Loadings as *de Luxe* version.

WEIGHTS AND LOADINGS (60-passenger version).—Weight empty (without equipment) 42,080 lbs. (19,077 kg.), Weight empty (equipped) 51,588 lbs. (23,400 kg.), Crew (7) 1,160 lbs. (526 kg.), Crew's baggage 210 lbs. (95 kg.), Fuel (1,722 Imp. gallons = 7,730 litres) 12,400 lbs. (5,624 kg.), Oil (73 Imp. gallons = 332 litres) 657 lbs. (298 kg.), Passengers (60) 10,200 lbs. (4,627 kg.), Passengers' baggage 3,000 lbs. (1,361 kg.), Food and drink 235 lbs. (107 kg.), Mail or freight 550 lbs. (249 kg.), Weight loaded 80,000 lbs. (36,287 kg.), Loadings as *de Luxe* version.

PERFORMANCE (At 80,000 lbs. = 36,287 kg.).—Maximum speed 330 m.p.h. (531 km.h.) at 20,500 ft. (6,250 m.), Cruising speed 285 m.p.h. (459 km.h.) at 22,500 ft. (6,860 m.), Initial rate of climb 870 ft./min. (265 m./min.), Service ceiling 28,600 ft. (8,720 m.), Three-engine service ceiling 22,400 ft. (6,830 m.), Range (*de Luxe* version with 9,511 lbs. = 4,314 kg. payload) 2,200 miles (3,740 km.), (40-passenger version with 9,354 lbs. = 4,243 kg. payload) 2,450 miles (3,943 km.), (60-passenger version with 13,985 lbs. = 6,344 kg. payload) 1,760 miles (2,832 km.), Take-off distance to 50 ft. (15 m.) 1,500 yds. (1,371 m.).

THE AVRO 689 TUDOR IV-VIII.

The Tudor Marks IV to VIII represent variations of the previously-described models, both of which are furnished to the requirements of British Overseas Airways.

The Avro Tudor II Airliner (four Rolls-Royce Merlin 621 engines).

***AVRO**—continued.*

The Avro Lancastrian III Long-range Transport (four 1,620 h.p. Rolls-Royce Merlin 24 engines).

The Mk. IV is similar to the Mk. I but has a longer forward fuselage and accommodation for 32 passengers. The Mk. V is similar to the Mk. II and can accommodate 44 day passengers and 28 night passengers. Both these marks are specially developed for British South American Airways.

The Mk. VI is similar to the Mk. II and will seat 32-38 day passengers with alternative night accommodation for 22. This version is intended for the Argentine F.A.M.A. concern.

The Mk. VII will be a Mk. II with a trial installation for four Bristol Hercules 120 radial air-cooled engines.

The Mk. VIII will be a Mk. II experimentally fitted with four Rolls-Royce Nene turbo-jet engines.

THE AVRO 691 LANCASTRIAN.

The Lancastrian is a high-speed long-range transport conversion of the Lancaster bomber, full details of which were given in the last issue of this Annual. The first conversions were made in Canada by Victory Aircraft, Ltd. for Trans-Canada Air Lines and are operated by this company, on behalf of the Canadian Government, on a trans-Atlantic mail and passenger service between Montreal and Prestwick. The Canadian Lancastrians are fitted with four 1,280 h.p. Packard-built Rolls-Royce Merlin 28 engines and have accommodation for ten passengers, mail and freight.

Production of the Lancastrian has since been undertaken by A. V. Roe & Co., Ltd. and deliveries have been made to the R.A.F., B.O.A.C. and British South American Airways.

The four main variants of the Lancastrian are designated as under:—

Mk. I. Nine-seat version for B.O.A.C.

Mk. II. Similar aircraft for R.A.F. Transport Command.

Mk. III. Thirteen-seat version for British South American Airways.

Mk. IV. Similar aircraft for R.A.F. Transport Command.

TYPE.—Four-engined Long-range Mail, Freight and Passenger Transport.

WINGS.—Cantilever mid-wing monoplane. Aerofoil section NACA 230 series. All-metal two-spar structure consisting of constant-chord centre-section integral with centre-section of fuselage; two tapered outer wings and detachable tips. Leading and trailing-edges detachable. All units are built up individually with all fittings and equipment before assembly. Spars have extruded top and bottom booms bolted to single heavy-gauge web plate. Pressed aluminium-alloy chordwise ribs flanged and swaged for stiffness. Smooth aluminium-alloy skin. Root chord 16 ft. 0 in. (4.88 m.); tip chord 7 ft. 6 in. (2.29 m.); aspect ratio 8.02; nett wing area 1,205 sq. ft. (112 sq. m.); gross wing area 1,297 sq. ft. (120.5 sq. m.). Balanced metal ailerons on outer wings are metal-covered to hinge, with fabric covering aft. Controllable trim-tabs in each. Aileron span 17 ft. 3 in. (5.33 m.). Aileron area 85.5 sq. ft. (7.94 sq. m.). Hydraulically-operated all-metal split trailing-edge flaps between ailerons and fuselage in two sections each side. Flap area 135.3 sq. ft. (12.56 sq. m.).

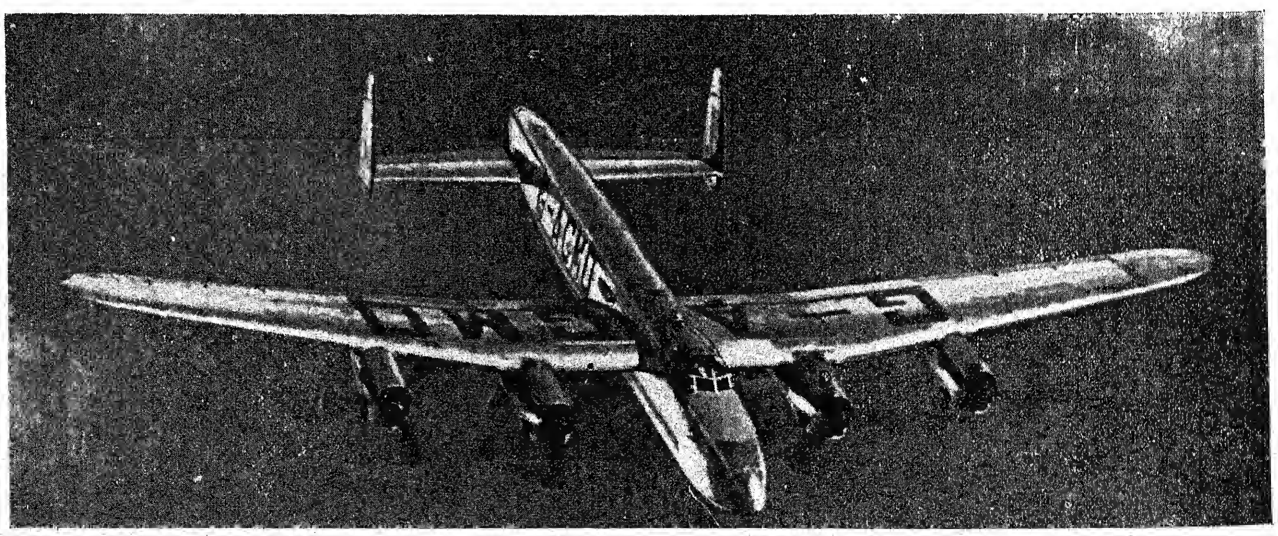
FUSELAGE.—All-metal structure of oval cross-section in five separately-assembled sections. Fuselage backbone formed by pairs of extruded longerons half-way down the three middle sections. Cross beams between longerons support floor and form roof of bomb-bay (on Lancaster). Vertical U-frames and formers bolted to longerons carry the smooth metal skin. Remaining sections consist of oval frames and formers, longitudinal stringers and flush-riveted metal skin. All equipment and fittings installed before final assembly of separate units. Nose and tail sections formed of smooth metal sheet and replace gun-turrets of Lancaster. Maximum internal width 5 ft. 3 in. (1.50 m.).

TAIL UNIT.—All-metal cantilever monoplane structure with twin fin and rudders mounted as endplates. Two-spar tailplane constructed in two main sections and joined on fuselage centre-line. Metal covering over all surfaces except elevators, which are fabric-covered. Controllable trim-tabs in rudders and elevators. Tailplane span 33 ft. 9 in. (10.28 m.); tailplane and elevator root chord 8 ft. 6 in. (2.59 m.). Gross tailplane area 143.9 sq. ft. (13.35 sq. m.); elevator area 87.3 sq. ft. (8.1 sq. m.); rudder area 41.2 sq. ft. (3.83 sq. m.).

LANDING GEAR.—Retractable two-wheel type. Each main wheel 5 ft. 6 in. (1.68 m.) diameter carried between pair of Dowty shock-absorber legs with diagonal cross-bracing and rear bracing struts, and retracts rearwards into inner engine nacelle, being fully enclosed in the retracted position by mechanically-operated twin doors. Hydraulic-operation. Track 23 ft. 9 in. (7.24 m.). Fixed tail-wheel carried in fork on shock-absorber leg.

POWER PLANT.—Four 1,620 h.p. Rolls-Royce Merlin 24 twelve-cylinder vee liquid-cooled engines with two-speed superchargers mounted on welded steel-tube bearers cantilevered from front wing-spar. D.H. Hydromatic three-blade constant-speed full-feathering airscrews, 13 ft. (3.96 m.) diameter. Fuel tanks in wing (2,154 Imp. gallons = 5,248 litres) and in bomb-bay (1,020 Imp. gallons = 4,640 litres).

ACCOMMODATION (Nine-passenger version).—Crew of four consisting of pilot (on port) and co-pilot side-by-side with dual controls, with navigator and wireless-operator behind. Crew compartment has



The Avro Lancastrian I Transport (four 1,620 h.p. Rolls-Royce Merlin 24 engines).

AVRO—*continued.*

volume of 285 cub. ft. (8.1 cub. m.). Aft of crew compartment is crew's toilet room, with volume of 135 cub. ft. (3.8 cub. m.). Aft of this is galley of 125 cub. ft. (3.5 cub. m.) capacity and seat for steward. Main cabin (capacity 570 cub. ft. = 16.1 cub. m.) follows, and has nine passenger seats on port side facing to starboard. Gangway on starboard. These seats are convertible into six bunks. Maximum cabin height 6 ft. 4 in. (1.93 m.). Windows on starboard side only. Main entry door on starboard side with coat-room opposite. Emergency escape hatches in roof. To the rear of main cabin is toilet compartment with volume of 93 cub. ft. (2.6 cub. m.). Rear luggage hold aft with capacity of 41 cub. ft. (1.2 cub. m.); loading hatch in roof. Forward freight compartment in nose has capacity of 227.5 cub. ft. (6.4 cub. m.); hinged nose-cap for loading.

Accommodation (13-passenger version).—Crew compartment, toilet and freight holds as on 9-passenger version. Crew's toilet reduced to 50 cub. ft. (1.4 cub. m.) capacity, and galley reduced to 85 cub. ft. (2.4 cub. m.). Main cabin of 695 cub. ft. (19.6 cub. m.) capacity accommodates thirteen passengers arranged in six seats on starboard and seven on port, with central aisle. All seats face forward except second seats from front, which face aft. Windows on both sides of cabin.

Equipment.—Two dinghies, one in each wing root trailing-edge and (on 9-passenger version) one in coat-room at rear. Oxygen bottle in floor under pilot's cockpit.

Dimensions.—Span 102 ft. (31.1 m.), Length 76 ft. 10 in. (23.4 m.), Height (tail down) 17 ft. 10 in. (5.44 m.).

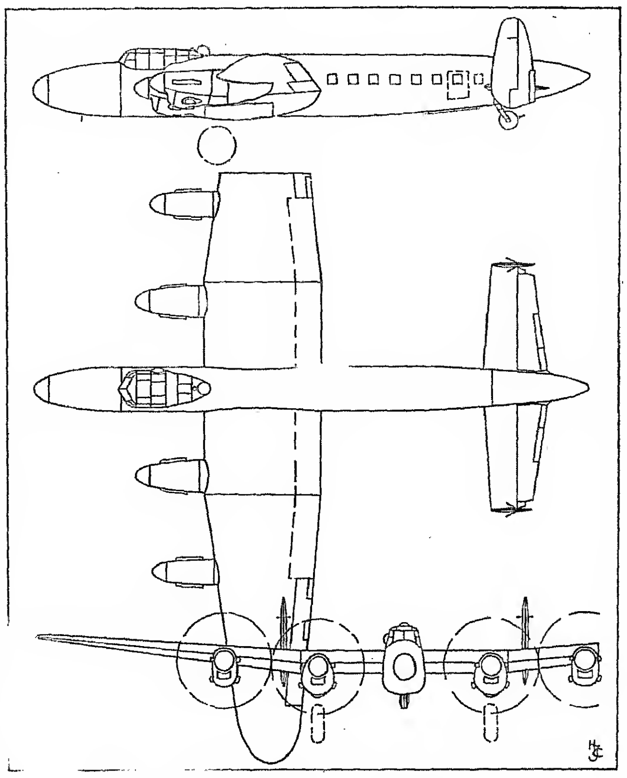
Weights and Loadings (Nine-passenger version).—Weight empty (fully equipped and furnished) 37,190 lbs. (16,870 kg.), Crew (5) baggage and food 1,100 lbs. (499 kg.), Passengers (9) 1,530 lbs. (694 kg.), Passengers' baggage (9 at 50 lbs. = 27 kg.) 450 lbs. (204 kg.), Mail or freight 210 lbs. (95 kg.), Fuel and oil 24,520 lbs. (11,122 kg.), Weight loaded 65,000 lbs. (29,484 kg.), Maximum landing weight 58,000 lbs. (26,309 kg.), Wing loading 50 lbs./sq. ft. (244.1 kg./sq. m.), Power loading 10 lbs./h.p. (4.53 kg./h.p.).

Weights and Loadings (Thirteen-passenger version).—Weight empty (fully equipped and furnished) 36,190 lbs (16,416 kg.), Crew (5), baggage and food 1,100 lbs. (499 kg.), Passengers (13) 2,210 lbs. (998 kg.), Passengers' baggage (13 at 50 lbs. = 27 kg.) 650 lbs. (295 kg.), Mail or freight 4,650 lbs. (2,110 kg.), Fuel and oil 17,060 lbs. (7,740 kg.), Normal weight loaded 61,860 lbs. (28,058 kg.), Maximum permissable weight loaded 65,000 lbs. (29,484 kg.), Maximum landing weight 58,000 lbs. (26,309 kg.), Wing loading (at normal loaded weight) 47.6 lbs./sq. ft. (232.4 kg./sq. m.), Power loading (at normal loaded weight) 9.5 lbs./h.p. (4.3 kg./h.p.).

Performance (Speeds at 54,000 lbs. = 24,494 kg.).—Maximum level speed 315 m.p.h. (507 km.h.) at 12,000 ft. (3,660 m.), Speed at sea level 285 m.p.h. (459 km.h.), Speed at 3,500 ft. (1,065 m.) 300 m.p.h. (483 km.h.), Maximum weak mixture cruising speed 290 m.p.h. (467 km.h.) at 17,500 ft. (5,335 m.) at sea level 245 m.p.h. (394 km.h.) at 11,000 ft. (3,355 m.) 280 m.p.h. (451 km.h.), Rates of climb (at 65,000 lbs. = 29,484 kg.), Maximum rate of climb (at maximum climbing power) 970 ft./min. (296 m./min.) at 10,000 ft. (3,050 m.) at sea level, 950 ft./min. (290 m./min.), Maximum rate of climb on three engines, 490 ft./min. (149 m./min.) at sea level; at 15,000 ft. (4,570 m.) 250 ft./min. (76 m./min.), Ceiling (at maximum climbing power) 25,000 ft. (7,620 m.), Service ceiling 24,300 ft. (7,405 m.), Three-engine ceiling 20,500 ft. (6,250 m.), Three-engine service ceiling 19,000 ft. (5,790 m.), Take-off distance to 50 ft. (15 m.) 1,200 yds. (1,097 m.), Landing run (at 42,000 lbs. = 19,051 kg.) 550 yds. (503 m.).

Ranges (Nine-passenger version).—(At optimum cruising conditions) 4,100 miles (6,598 km.) at 230 m.p.h. (370 km.h.) at 20,000 ft. (6,095 m.) with 2,190 lbs. (993 kg.) payload; 3,280 miles (5,278 km.) at 280 m.p.h. (451 km.h.) at 20,000 ft. (6,095 m.) with 4,340 lbs. (1,969 kg.) payload. (At maximum weak mixture cruising conditions) 3,600 miles (5,793 km.) at 280 m.p.h. (451 km.h.) at 20,000 ft. (6,095 m.) with 2,190 lbs. (993 kg.) payload; 3,200 miles (5,150 km.) at 280 m.p.h. (451 km.h.) at 20,000 ft. (6,095 m.) with 4,850 lbs. (2,200 kg.) payload.

Ranges (Thirteen-passenger version).—(At optimum cruising conditions) 2,820 miles (4,538 km.) at 230 m.p.h. (370 km.h.) at 20,000 ft. (6,095 m.) with 7,510 lbs. (3,406 kg.) payload; 2,710 miles (4,361 km.) at 230 m.p.h. (370 km.h.) at 20,000 ft. (6,095 m.) with 10,650 lbs. (4,831 kg.) payload. (At maximum weak mixture cruising conditions) 2,450 miles (3,943 km.) at 280 m.p.h. (451 km.h.) at 20,000 ft. (6,095 m.) with 7,510 lbs. (3,406 kg.) payload; 2,420 miles (3,894 km.) at 280 m.p.h. (451 km.h.) at 20,000 ft. (6,095 m.) with 10,650 lbs. (4,831 kg.) payload.



The Avro Lancastrian III Transport.

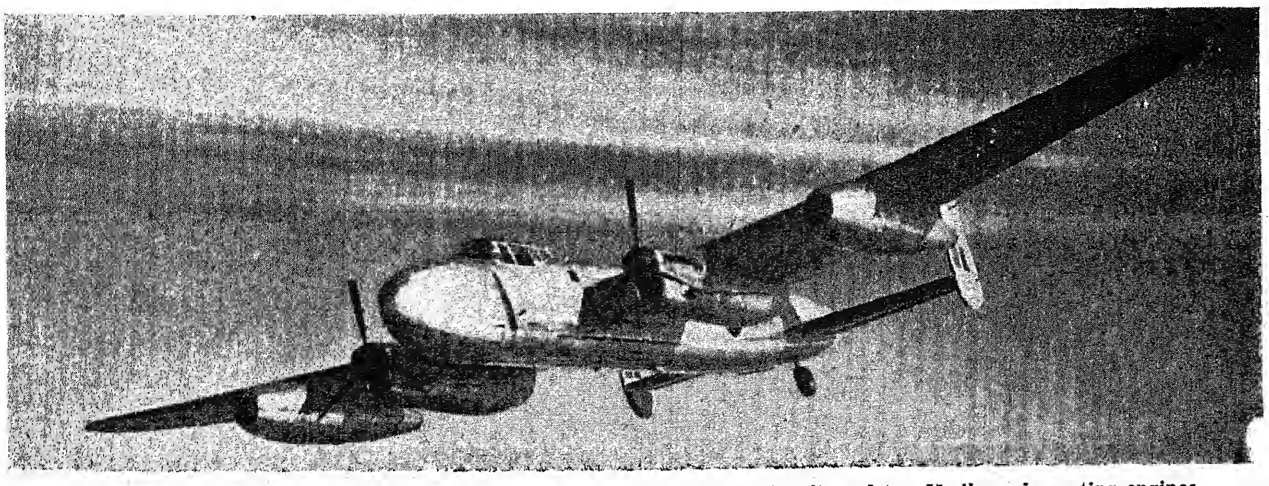
THE AVRO NENE-LANCASTRIAN.

An experimental version of the Lancastrian is fitted with two Rolls-Royce Nene centrifugal-flow turbo-jet units in place of the outboard Merlin engines. The object of this installation is to obtain performance figures of a jet-propelled air-liner, and generally to investigate the efficiency of the jet engines so installed.

Modification work was completed by Rolls-Royce Ltd., with the approval of A. V. Roe & Co. Ltd., and the Nene Lancastrian made its first flight at Hucknall in August, 1946. Alteration to the main spar, ailerons and flaps and the control runs between the inner and outer engines, was necessitated by the jet unit installation. Extensive experimental equipment is carried, including separate sets of instruments for the Merlin engines and the Nene jet-units.

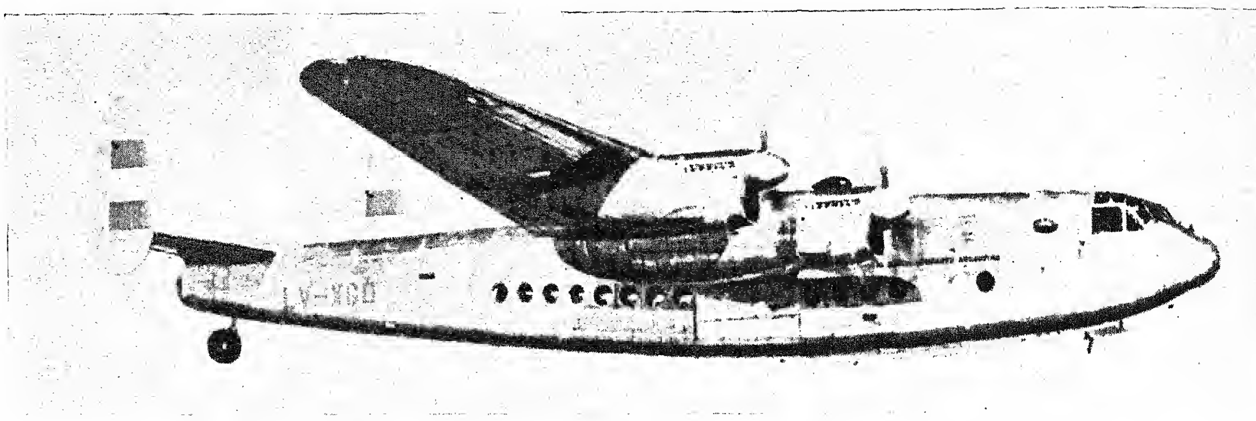
The Nene Lancastrian has a considerably improved performance over the standard aircraft. Altitude can be maintained easily on three engines, and the aircraft has been flown satisfactory with both Merlins and one Nene stopped. The additional fuel required for the jet-units is accommodated in auxiliary tanks in the fuselage. The standard wing tanks, three in each wing, are retained. Two of them carry kerosene and one petrol. Total capacity is 2,385 Imp. gallons (10,848 litres) paraffin and 740 Imp. gallons (3,364 litres) petrol. The weight loaded is 62,570 lbs. (28,381 kg.).

Using only the Nene engines this aircraft has a range of over 800 miles (1,287 km.).



The Avro Nene-Lancastrian powered by two Rolls-Royce Nene turbo-jet units and two Merlin reciprocating engines.

***AVRO**—continued.*



The Avro York Commercial Airliner (four 1,620 h.p. Rolls-Royce Merlin 24 engines).

THE AVRO 685 YORK.

The York four-engined transport monoplane was developed from the Lancaster bomber. It was introduced in 1942 as an interim type pending the completion of newer types designed primarily for transport duties. To expedite production the York was designed to incorporate many of the features of the Lancaster bomber, including the wings, engines, landing gear and tail unit. A radically new fuselage of large capacity was designed, and the wing was mounted at the top of the fuselage instead of in the mid position as on the Lancaster. After the first prototype had flown a third central fin was added, and this was retained on all production aircraft.

The York is still used widely by the R.A.F. (as the C. Mk. I), and by numerous air lines, including the British Overseas Airways Corporation, British South American Airways, South African Airways and the Argentine F.A.M.A. Company.

The following specification gives particulars of the four current versions. Structurally the York is similar to the Lancastrian, except for the fuselage.

Type.—Four-engined Long-range Transport.

Wings.—Cantilever high-wing monoplane. Wing identical with Lancastrian, but mounted at top of fuselage. Dimensions and areas as Lancastrian, but with increased dihedral (7 degrees) on outer wings. Aspect ratio 8.63.

Fuselage.—All-metal semi-monocoque structure of roughly rectangular cross-section built in five main sections. Construction consists of vertical channel-section frames and formers, top-hat section stringers and flush-riveted metal skin. Reinforced floor structure.

Tail Unit.—As Lancastrian, but mounted in high-wing position, and with additional fin over fuselage centre-line. Areas as Lancastrian except fin area (total) 107.5 sq. ft. (10 sq. m.).

Landing Gear.—As Lancastrian.

Power Plant.—As Lancastrian. Normal fuel capacity 2,478 Imp. gallons (11,271 litres); oil capacity 150 Imp. gallons (682 litres).

Accommodation (Heavy freighter version).—Crew compartment forward, separated from main cabin by soundproof bulkhead fitted with sliding door. Provision for four or five crew members, varying according to duty. Entire fuselage space available for freight carrying, with loading door 8 ft. × 6 ft. (2.44 m. × 1.83 m.) aft of wing trailing-edge on port side. Lashing points in floor and on sides. Special loading ramp stowed at rear. Toilet compartment forward.

Accommodation (Passenger-Freighter version).—Passenger cabin extends from mid-chord position to aft of trailing-edge, and has 12 seats arranged four double seats on starboard and four single seats on port, all facing forward. Two toilet compartments at rear. Kitchen, with refrigerator, etc., and luggage compartment with capacity of 200 cub. ft. (5.66 cub. m.) aft; freight loading hatch on starboard side. Main freight compartment extends from crew compartment to passenger cabin. Entry door on port side of fuselage under wing.

Accommodation (21-passenger version).—Main passenger accommodation extends from crew compartment to kitchen at rear and is arranged to accommodate 21 passengers in two cabins; six passengers in forward cabin and 15 aft. Double seats on starboard side and single seats on port. Two toilet compartments on starboard side between cabins. Main entry door between cabins on port side. Coat-room on left of entry door. Kitchen and rear luggage compartment as on passenger-freighter version. Two luggage compartments forward, one of 60 cub. ft. (1.7 cub. m.) capacity on port, and one of 130 cub. ft. (3.67 cub. m.) capacity on starboard.

Accommodation (24-passenger version).—Generally as 21-passenger version, but with three additional seats forward in place of luggage compartments.

Weights and Loadings (Heavy freighter version).—Weight empty (equipped) 39,458 lbs. (17,899 kg.), Crew (4) 680 lbs. (308 kg.), Crew's baggage 100 lbs. (45 kg.), Fuel and oil 19,192 lbs. (8,705 kg.), Water 125 lbs. (57 kg.), Total freight load 11,445 lbs. (5,192 kg.), Maximum weight loaded 71,000 lbs. (32,206 kg.), Maximum landing weight (on grass) 58,000 lbs. (25,909 kg.), Maximum landing weight (on concrete) 60,000 lbs. (27,216 kg.), Wing loading 54.6 lbs./sq. ft. (266.6 kg./sq. m.), Power loading 10.9 lbs./h.p. (4.93 kg./h.p.).

Weights and Loadings (Passenger-Freighter version).—Weight empty (equipped) 41,605 lbs. (18,872 kg.), Crew (4) 680 lbs. (308 kg.), Crew's baggage 100 lbs. (45 kg.), Fuel and oil 19,192 lbs. (8,705 kg.), Water 200 lbs. (91 kg.), Food 120 lbs. (56 kg.), Passengers (12) 2,040 lbs. (925 kg.), Passengers' baggage 600 lbs. (272 kg.), Freight 6,463 lbs (2,932 kg.), Weight loaded 71,000 lbs. (32,206 kg.). Landing weights and loadings as Heavy Freighter version.

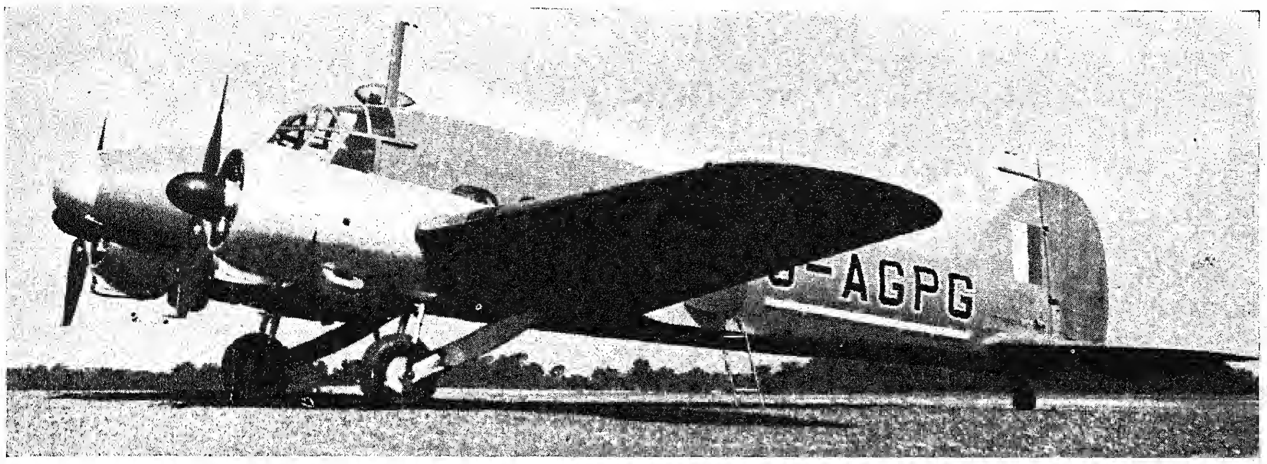
Weights and Loadings (21-passenger version).—Weight empty (equipped) 43,438 lbs. (19,704 kg.), Crew (5) 820 lbs. (372 lbs.), Crew's baggage 125 lbs. (57 kg.), Fuel and oil 19,192 lbs. (8,705 kg.), Water 300 lbs. (136 kg.), Food 125 lbs. (57 kg.), Passengers (21) 3,570 lbs. (1,619 kg.), Passengers' baggage 1,050 lbs. (476 kg.), Mail 2,380 lbs. (1,080 kg.), Weight loaded 71,000 lbs. (32,206 kg.). Landing weights and loadings as Heavy Freighter version.

Weights and Loadings (24-passenger version).—Weight empty (equipped) 42,040 lbs. (19,069 kg.), Crew (5) 820 lbs. (372 kg.). Crew's baggage 125 lbs. (57 kg.), Fuel and oil 19,192 lbs. (8,705 kg.), Water 200 lbs. (91 kg.), Food 140 lbs. (63 kg.), Passengers (24) 4,080 lbs. (1,851 kg.), Passengers' baggage 1,200 lbs. (544 kg.), Mail 800 lbs. (363 kg.), Weight loaded 68,597 lbs. (31,115 kg.), Maximum landing weights as Heavy Freighter version), Wing loading 52.8 lbs./sq. ft. (257.76 kg./sq. m.), Power loading 10.58 lbs./h.p. (4.8 kg./h.p.).

Performance (At 71,000 lbs. = 32,206 kg.).—Maximum level speed 306 m.p.h. (492 km.h.) at 10,800 ft. (3,290 m.). Maximum level speed at sea level 284 m.p.h. (457 km.h.), Cruising speed at 10,500 ft. (3,290 m.) 251 m.p.h. (404 km.h.), Cruising speed at sea level 203 m.p.h. (327 km.h.), Maximum rate of climb 1,500 ft./min (457 m./min.) Rate of climb at 10,500 ft. (3,290 m.) 680 ft./min.. (207 m./min.), Climb to 10,500 ft. (3,290 m.) 12.8 minutes, Take-off distance to 50 ft. (15 m.) 1,880 yds. (1,719 m.), Service ceiling 23,000 ft. (7,010 m.).

Performance (At 61,000 lbs. = 27,670 m.).—Maximum level speed 310 m.p.h. (499 km.h.) at 10,800 ft. (3,290 m.), Maximum level speed at sea level 287 m.p.h. (462 km.h.), Cruising speed at 10,500 ft. (3,290 m.) 259 m.p.h. (417 km.h.), Cruising speed at sea level 211 m.p.h. (340 km.h.), Maximum rate of climb 1,900 ft./min.

The Avro York C. Mk. I Military Transport (four 1,620 h.p. Rolls-Royce Merlin 24 engines).



The Avro XIX Light Transport (two 420 h.p. Armstrong Siddeley Cheetah XV engines).

(579 m./min.), Rate of climb at 10,500 ft. (3,290 m.) 970 ft./min. (296 m./min.), Climb to 10,500 ft. (3,290 m.) 9.6 minutes, Landing distance from 50 ft. (15 m.) 1,200 yds. (1,097 m.), Service ceiling 26,000 ft. (7,925 m.).

Performance (On three engines, at 71,000 lbs. = 32,206 kg.).—Maximum cruising speed 214 m.p.h. (339 km.h.), Maximum rate of climb 900 ft./min. (274 m./min.), Rate of climb at 10,500 ft. (3,290 m.) 240 ft./min. (73 m./min.), Climb to 10,500 ft. (3,290 m.) 26.4 minutes, Service ceiling 19,500 ft. (5,945 m.).

Performance (On three engines at 61,000 lbs. = 27,670 kg.).—Maximum cruising speed 228 m.p.h. (367 km.h.), Rate of climb at 10,500 ft. (3,290 m.) 475 ft./min. (145 m./min.), Climb to 10,500 ft. (3,290 m.) 18 minutes, Service ceiling 23,000 ft. (7,010 m.).

Maximum Ranges (At 68,000 lbs. = 30,845 kg. at 10,000 ft. = 3,050 m.).—Heavy Freighter version 2,700 miles (4,345 km.) with 8,500 lbs. (3,855 kg.) payload, Passenger-Freighter version 2,700 miles (4,345 km.) with 6,500 lbs. (2,948 kg.) payload, 21-passenger version 2,700 miles (4,345 km.) with 4,500 lbs. (2,041 kg.) payload.

THE AVRO 652A TYPE XIX.

The Type XIX is a commercial development of the Anson and is widely used on civilian and military communications duties. The Anson (Type 652A) itself was originally produced in 1935 as a general reconnaissance monoplane and was a development of the Type 652, two of which were produced in 1935 for Imperial Airways. The Anson appeared in many different forms for reconnaissance, training and communications work, and details of the various marks (including those built in Canada), together with a full structural specification, appeared in the last Edition of "All the World's Aircraft." Many Ansons, notably the Marks I, X and XII, are still in use in the R.A.F. Approximately 12,000 Ansons have been built.

The Avro XIX is generally similar to the earlier aircraft, but the cabin roof has been raised slightly to provide more head space for the passengers. The later Ansons, from the Mk. XI onwards, were also modified in this way. Apart from this improvement the Type XIX remains basically the same as the original Anson I.

Variations of the Type XIX include a special long-range version supplied to the Ministry of Civil Aviation for executive transport; a photographic aircraft supplied to the Eire Army Air Corps, and a general purposes military version for the Iraqi Air Force.

The following description, except where indicated, applies specifically to the civilian Avro XIX.

Type.—Twin-engined Feeder-line Monoplane.

Wings.—Cantilever low-wing monoplane. Wooden two-spar structure built in one piece and attached to fuselage at eight steel pick-up points on spars. Constant taper in chord and thickness from root. Box-type spars with laminated booms and double webs, chordwise ribs, longitudinal stringers and plywood skin. Synthetic glue used throughout. Incidence 4 degrees; dihedral 4 degrees; aspect ratio 6.9; root chord 10 ft. 6 in. (3.20 m.); mean chord 8 ft. 4 in. (2.54 m.); nett wing area 410 sq. ft. (38.1 sq. m.); gross wing area 463 sq. ft. (43 sq. m.). Frise-type wooden ply-covered ailerons; total area 32.4 sq. ft. (3.0 sq. m.). All-wood split trailing-edge flaps between ailerons and fuselage. Single-spar structure with ply-covering. Hydraulic operation.

Fuselage.—Welded steel-tube structure with wooden vertical frames, longitudinal stringers and fabric covering. Nose-section ply-covered.

Tail Unit.—Cantilever monoplane type. Construction generally to mainplane. All-wood two-spar structure in one piece. Balanced elevators with trim-tab in each. Tailplane span 23 ft. 0 in. (7.01 m.); tailplane and elevator root chord 5 ft. 11 in. (1.80 m.); tailplane area 62.3 sq. ft. (5.77 sq. m.); elevator area 22.5 sq. ft. (2.07 sq. m.); fin area 11.5 sq. ft. (1.07 sq. m.); rudder area 19.4 sq. ft. (1.80 sq. m.).

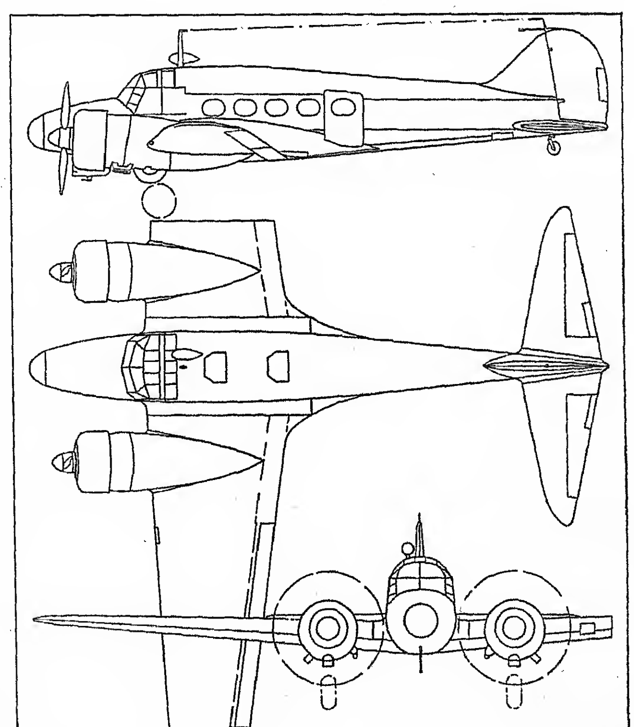
Landing Gear.—Retractable two-wheel type. Each main wheel carried between pair of Turner pneumatic shock-absorber legs with heavy central rear actuating strut. Hydraulic operation. Track 13 ft. 8 in. (4.16 m.). Non-retractable tail-wheel carried on Turner hydraulic shock-absorber leg.

Power Plant.—Two Armstrong Siddeley Cheetah XV seven-cylinder radial air-cooled engines each rated at 420 h.p. for take-off at 2,550 r.p.m. with 4 lbs./sq. in. (0.28 kg./sq. c/m.) boost, mounted on welded steel-tube bearers attached to welded steel channels in wing. Up-thrust 3 degrees 46 minutes. Quickly-detachable installations. Rotol two-blade constant-speed airscrews, 8 ft. 4 in. (2.56 m.) diameter. Four 35-Imp. gallon (159 litre) fuel tanks in wings. Long-range version has extra 40-Imp. gallon (182-litre) fuel tank installed in fuselage. 87 or 100 Octane fuel. Two 7.5 Imp. gallon (34-litre) oil tanks, one in each engine nacelle. Nine-element Vickers-Pott oil-cooler.

Accommodation.—Crew of two consisting of pilot (on port) and radio-operator/navigator side-by-side, with provision for dual controls. Main cabin accommodates six passengers, three on each side of central gangway, or nine passengers with five seats on starboard and four on port. Elsan toilet compartment at rear on starboard side on six-passenger version. Racks for light luggage above seats. Main entry door on port side of fuselage at rear of cabin. Forward freight compartment in nose, with nose-cap hinged at top for access; capacity 17 cub. ft. (1.58 cub. m.); allowance 175 lbs. (79 kg.). Rear compartment aft of cabin 5 ft. high × 3 ft. long × 3 ft. wide (1.52 m. × 0.91 m. × 0.91 m.) has capacity of 40 cub. ft (1.13 cub. m.) and allowance of 325 lbs. (147 kg.) Access door on starboard side of fuselage.

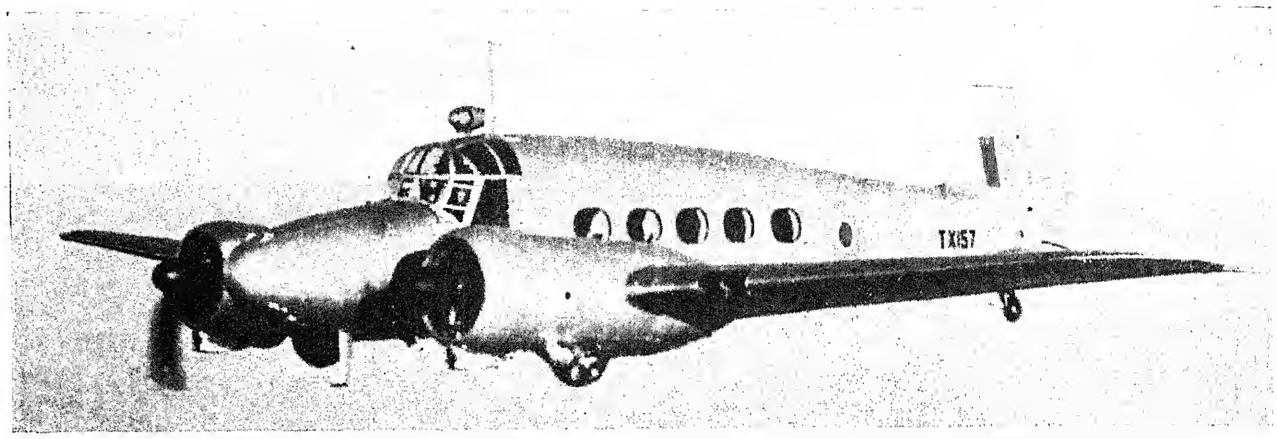
Accommodation (Long-range version).—Crew of four consisting of pilot (on port) and observer side-by-side, flight engineer behind pilot, and wireless-operator on starboard. Crew compartment increased by moving bulkhead back to rear spar. Three passenger seats in main cabin, one on port facing forward and two on starboard facing each other, with table between. Toilet compartment on starboard side aft of rear spar. Luggage allowance 70 lbs. (32 kg.).

Accommodation (Photographic and General Purpose versions).—Flight crew of four, consisting of pilot and co-pilot side-by-side with dual controls, and wireless-operator and navigator behind between spars. Wireless-operator (on starboard) faces aft;



The Avro XIX Light Twin-engined Transport.

***AVRO**—continued.*



The Avro XIX Military Communications Monoplane (two 420 h.p. Armstrong Siddeley Cheetah XV engines).

navigator (on port) faces forward, with chart-table in front and astro-dome abovo. Bulkhead at rear spar separates crew compartment from main cabin. Provision for fitting Eagle IX or F-24 camera in floor aft of rear spar on starboard side. Rear windows on each side removable to permit oblique photography. Three seats in main cabin; one behind camera and two on port.

ARMAMENT (General Purposes version).—Two manually-operated Vickers K guns installed on port and starboard sides as alternative to oblique cameras. One forward-firing .303 in. (7.7 m/m.) Browning machine-guns on port side of cockpit. Provision for carrying two 100 lbs. (45 kg.) and eight 10 lbs. (4.5 kg.) bombs, or one 250 lbs. (113 kg.) and eight 10 lbs. (4.5 kg.) bombs. Prone bomb-aiming position in nose.

EQUIPMENT.—24-volt electric system. Heywood Compressor pneumatics. Hydraulic system operating at 800 lbs./sq. in. (56.25 kg./sq. c/m.).

DIMENSIONS.—Span 56 ft. 6 in. (17.22 m.), Length 42 ft. 3 in. (12.87 m.), Height (tail down) 13 ft. 6 in. (4.11 m.).

WEIGHTS AND LOADINGS (Six-passenger version).—Weight empty 7,419 lbs. (3,365 kg.), Equipment 352 lbs. (160 kg.). Crew 340 lbs. (154 kg.), Passengers 1,020 lbs. (463 kg.), Baggage 153 lbs. (69 kg.), Fuel and oil 1,116 lbs. (506 kg.), Weight loaded 10,400 lbs. (4,717 kg.), Wing loading 22.4 lbs./sq. ft. (109.3 kg./sq. m.), Power loading 12.37 lbs./h.p. (5.6 kg./h.p.).

WEIGHTS AND LOADINGS.—Eight-passenger version).—Weight empty 7,419 lbs. (3,365 kg.), Equipment 14.5 lb. (67 kg.)., Crew 340 lbs. (154 kg.), Passengers 1,530 lbs. (694 kg.), Baggage 226 lbs. (103 kg.), Fuel and oil 736 lbs. (334 kg.), Weight loaded 10,400 lbs. (4,717 kg.), loadings as six-passenger version.

PERFORMANCE.—Maximum speed 190 m.p.h. (306 km.h.) at 5,000 ft. (1,525 m.), Maximum cruising speed 174 m.p.h. (280 km.h.) at 5,800 ft. (1,770 m.), Economic cruising speed 155 m.p.h. (249 km.h.) at 3,000 ft. (915 m.), Stalling speed (flaps and landing gear down) 60 m.p.h. (97 km.h.), Initial rate of climb 750 ft./min. (229 m/min.), Service ceiling 19,000 ft. (5,790 m.), One-engine ceiling 5,750 ft. (1,755 m.), Range (with six passengers) 610 miles (982 km.), Range (with nine passengers) 356 miles (573 km.), Range (long-range version) 820 miles (1,320 km.), Take-off distance to 50 ft. (15 m.) 700 yds. (640 m.), Landing distance from 50 ft. (15 m.) 570 yds. (521 m.), Fuel consumption 33 Imp. gallons (150 litres) per hour.

THE AVRO 652A TYPE XIX (METAL WING VERSION).

Tests have been completed with a metal wing and tailplane to replace the wooden structures on the earlier Avro XIX. The new wing is constructed in five sections comprising the centre-section carrying the engine nacelles, two outer wings and detachable tips.

Construction is of the two-spar type, with ribs and skin carrying shear loads only. The spars consist of fully-machined, extruded light alloy booms, with light alloy webs carrying stiffeners at each rib station. The spar joint between the centre-section and outer wing is by parallel link shackles on the booms, with high-tensile steel bolts and shear plates joining the webs. The outer wings are completely interchangeable and the main bolt attachment holes have replaceable bushes so that wear can be accommodated without the use of oversize bolts.

Each main rib is composed of nose, centre and trailing portions. The centre portions, of light-alloy sheet, with pressed flanged lightening holes and fluted for stiffening, aro attached by angles to the front and rear spar webs and by flanges to the wing skin. The nose portion is of similar construction, while the trailing-edge rib pressings are reinforced by angle stiffeners to carry the air loads induced by the landing flaps. Skin covering is of Alclad sheet throughout, reinforced by span-wise stringers at the lap joints.

The tailplane is in one piece and is easily detachable, and follows the general form of construction employed in the wing. The elevators are connected by a single torque-tube across the fuselage.

THE AVRO 694 LINCOLN.

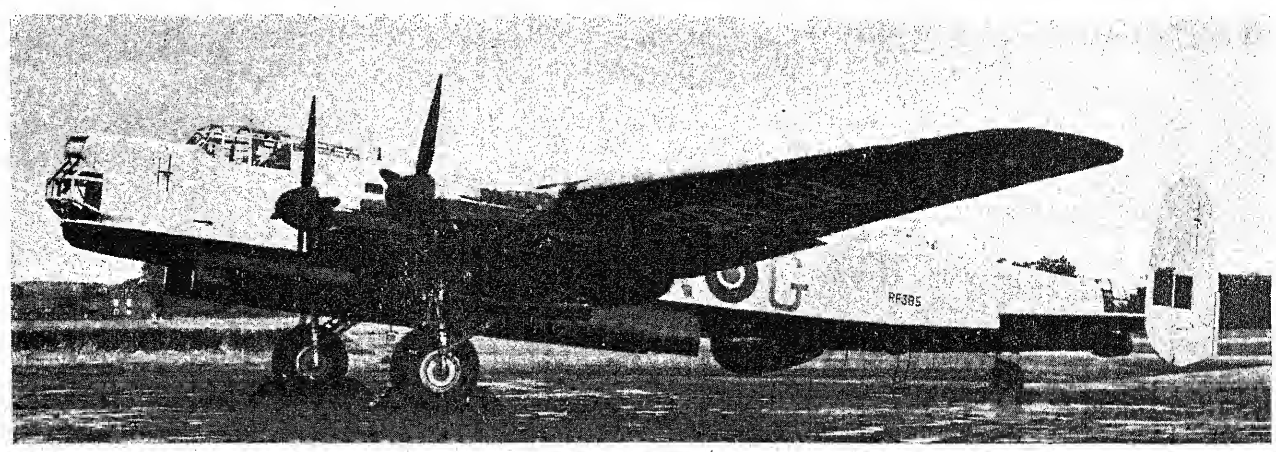
The Lincoln, conforming to Specification 14/43, is a four-engined heavy bomber which is virtually a scaled-up version of the Lancaster. The Lincoln I and II were in fact known originally as the Lancaster IV and V.

The Lincoln was intended for use in the Pacific Theatre, but appeared just too late to be flown operationally. Various modifications and improvements were incorporated in the design as a result of experience with the Lancaster. The overall dimensions were increased to permit greater load-carrying abilities and .50 in. (12.7 m/m.) machine-guns were fitted in all positions. Later versions carry two 20 m/m. cannon in the dorsal turret.

The Lincoln I is powered by 1,750 h.p. Rolls-Royce Merlin 85 engines driving Rotol four-blade airscrews, while the Mk. II has Merlin 68 (Packard-built 66) or Merlin 300 (Packard-built 100) engines driving D.H. Hydromatic airscrews.

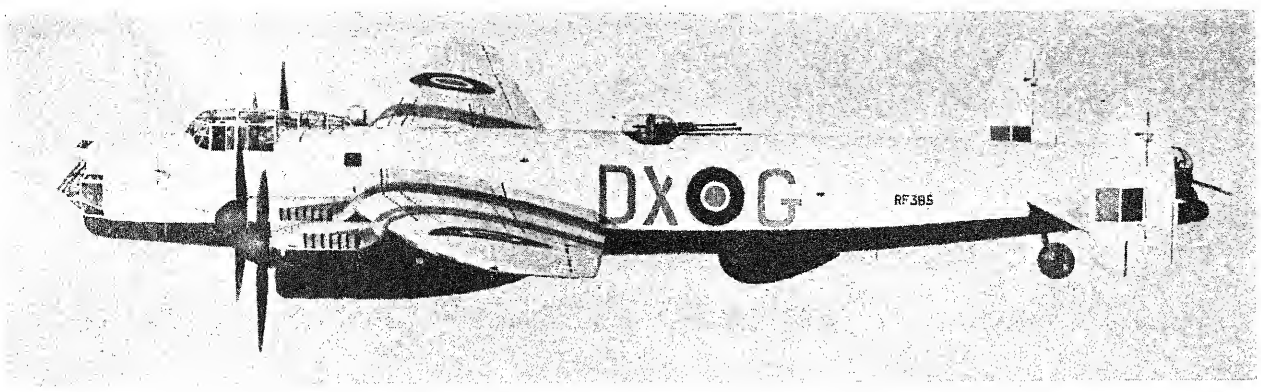
The designation Mk. XV was given to the version of the Lincoln I built by Victory Aircraft, Ltd. of Canada (since acquired by A. V. Roe & Co. Ltd.). Six aircraft were built and they were converted to freighters for the Royal Canadian Air Force.

The Lincoln was also put into production by the Beaufort Division of the Australian Department of Aircraft Production and was re-designated the Mk. 30. The first five aircraft were completed partly from components sent from Great Britain, but subsequent aircraft will be entirely Australian-built. The first of a total order for 61 was flown on March 17th, 1946. The



The Avro Lincoln II Heavy Bomber (four Rolls-Royce Merlin 68 engines).—(*The Aeroplane*).

AVRO*—*continued.



The Avro Lincoln II Heavy Bomber (four Rolls-Royce Merlin 68 engines).—(*The Aeroplane*).

first batch of Australian-built Lincolns are fitted with Packard-built Merlin 85 engines but later the Australian-built Merlin 102 will be fitted.

TYPE.—Four-engined Heavy Bomber.

WINGS.—All-metal cantilever mid-wing monoplane. Aerofoil section NACA 23000 Series. Wing built in five main sections; centre-section integral with fuselage and bearing inner engine nacelles and undercarriage attachments: two intermediate sections bearing outer nacelles; and two outer wings. Trailing-edge of intermediate sections built separately. Detachable tips. Two-spar structure. Centre-section spars of extruded square-section booms bolted to plate webs with vertical top-hat section stabilisers. Oute spars have extruded spindled booms of U-section tapering to angle-section towards tips, and plate webs. Ribs of pressed diaphragm type, with heavy engine ribs and joint ribs of N-girder construction. Light alloy top-hat section spanwise stringers in leading and trailing-edge sections and between spars of centre-section over fuel tanks. Stressed light alloy skin. Mean aerodynamic dihedral 4 degrees. Gross wing area 1,421 sq. ft. (132 sq. m.). All-metal ailerons in two sections; metal covering. Auto servo-tab and hand trim-tabs. Hydraulically-operated split trailing-edge flaps in two sections between ailerons and fuselage with stiffening of light alloy castellated reinforcement.

FUSELAGE.—All-metal semi-monocoque structure built in five main sections bolted together; nose section. with front gun-turret; cabin section; centre-section; aft section bearing dorsal turret; and tail-section bearing tail-unit and rear turret. Channel-section frames and continuous angle-section longitudinal stringers. Stressed skin of longitudinal light alloy panels. Main bomb floor of two cast C-beams with two cast C-intercostals to carry main bomb suspension, bounded by extruded members of flanged channel-section.

TAIL UNIT.—All-metal cantilever structure, standard Lancaster unit except for slight increase of rudder area. Low-mounted two-spar tailplane carrying twin elliptical fins and rudders at extremities. Sheet metal covering on all surfaces. Inset trim-tabs in all movable surfaces; automatic balance-tabs in elevators. Mass balances. Tailplane span 33 ft. 9 in. (10.28 m.).

LANDING GEAR.—Retractable two-wheel type. Each main wheel carried between two Dowty shock-absorber legs attached to girder casting below front spar and retracting backwards into inner nacelles. Hydraulic operation, with emergency-lowering compressed-air system. Track 23 ft. 9 in. (7.24 m.). Non-retractable tailwheel.

POWER PLANT.—Four 1,635 h.p. Rolls-Royce Merlin 85 or Packard-Merlin 68 twelve-cylinder vee liquid-cooled engines mounted as power-eggs on welded steel-tube bearers, and enclosed in cylindrical cowlings. Rotol or De Havilland four-blade constant-speed full-feathering airscrews, 13 ft. 0 in. (3.96 m.) diameter. Six main fuel tanks; one light alloy tank in each centre-section and two Marston flexible tanks in each intermediate wing panel. Total fuel capacity 3,580 Imp. gallons (16,277 litres). Oil capacity 150 Imp. gallons (682 litres).

ACCOMMODATION.—Crew of seven; front gunner/bomb-aimer; pilot; flight engineer/co-pilot; navigator; wireless-operator; dorsal gunner and rear gunner. Pilot's seat on port with armoured back-plate. Nose-window of welded steel-tube framework with toughened glass and Perspex panels.

ARMAMENT.—Twin .5 in. (12.7 m/m.) Browning machine-guns in Boulton Paul Type F nose-turret remotely-controlled from bomb-aimer's seat, with Mk. IIIM periscopic sight; two 20 m/m. Hispano Mk. IV or Mk. V cannon in Bristol B-17 Mk. I dorsal turret; twin .5 in. (12.7 m/m.) Browning machine-guns in Boulton Paul Type D rear turret with radar sight. Maximum bomb-load 22,000 lbs. (9,979 kg.).

EQUIPMENT.—24-volt electric system. Full radar and radio gear. Inflatable dinghy in tail of fuselage. F-24 camera.

DIMENSIONS.—Span 120 ft. (36.57 m.), Length 78 ft. 3½ in. (23.85 m.), Height (tail down, over rudders) 17 ft. 3½ in. (5.26 m.).

WEIGHTS AND LOADINGS.—Weight empty (equipped) 44,188 lbs. (20,044 kg.), Weight loaded 82,000 lbs. (37,194 kg.), Wing loading 52.77 lbs./sq. ft. (257.62 kg./sq. m), Power loading 12.2 lbs./h.p. (5.53 kg./h.p.), Span loading 5.7 lbs./sq. ft. (27.82 kg./sq. m.).

PERFORMANCE.—Maximum speed 310 m.p.h. (499 km.h.) at 18,300 ft. (5,575 m.), Stalling speed (flaps and undercarriage down) 75 m.p.h. (121 km.h.), Maximum range (at 82,000 lbs. = 37,194 kg., still air at 215 m.p.h. = 346 km.h. at 20,000 ft. = 6,095 m.) 4,000 miles (6,437 km.). Range (at 260 m.p.h. = 418 km.h. with 14,000 lbs. = 5,350 kg. bomb-load) 3,250 miles (5,230 km.). Range (at 260 m.p.h. = 418 km.h. with 22,000 lbs. = 9,979 kg. bomb-load) 1,150 miles (1,850 km.).

BLACKBURN.

BLACKBURN AIRCRAFT, LTD.

HEAD OFFICE, WORKS, AERODROME AND SEAPLANE BASE: BROUGH, E. YORKS.

SCOTTISH WORKS: CASTLE ROAD, DUMBARTON.

LONDON OFFICE: 11, UPPER GROSVENOR STREET, W.1.

Chairman and Joint Managing Director: Robert Blackburn, O.B.E., A.M.I.C.E., F.R.Ae.S., M.I.Mech.E.

Directors: Major F. A. Bumpus, B.Sc., A.R.C.S., Wh.Sc., F.R.Ae.S. (Joint Managing Director), Sir Maurice Denny, Bt., C.B.E., B.Sc., M.I.C.E., M.I.N.A., W. S. Farren, C.B., M.B.E., M.A., F.R.S., M.I.Mech.E., F.R.Ae.S., Capt. N. W. G. Blackburn, R. R. Rhodes, F.R.Ae.S. and Sq. Ldr. J. L. N. Bennett-Baggs, A.F.R.Ae.S.

Secretary: A. F. Jopling, A.C.A.

Chief Designer G. E. Petty, F.R.Ae.S.

The Blackburn Company was founded by Mr. Robert Blackburn, who produced his first aeroplane in 1910 and has continued to manufacture aircraft ever since.

Although the Blackburn Company has concentrated mainly on naval types and specialises in torpedo-carrying aircraft, its experience covers a wide range of types, from the single-engined light aeroplane to the multi-engined flying-boat.

In 1936, the Blackburn Company came to an arrangement with the famous Scottish shipbuilding company of William Denny & Bros. Ltd., of Dumbarton, to organise and operate jointly a factory on the Clyde, and Sir Maurice Denny joined the Board of the Blackburn Company.

In 1937, the Blackburn Company received a contract for the production of the Blackburn Skua fighter dive-bomber. In 1938 the Roc was adopted for use by the Fleet Air Arm.

During the war the Company devoted a large part of its production facilities to the manufacture of aircraft of outside design. Large contracts were fulfilled for the Fairey Swordfish and Barracuda torpedo-bombers and the Short Sunderland flying-boat. It was also engaged in the modification of American aircraft for the Royal Navy.

The latest Blackburn design which may be mentioned is the Firebrand, a description and illustrations of which appear herewith. At the time of writing the Company was preparing for production of the Percival Prentice training monoplane under sub-contract.

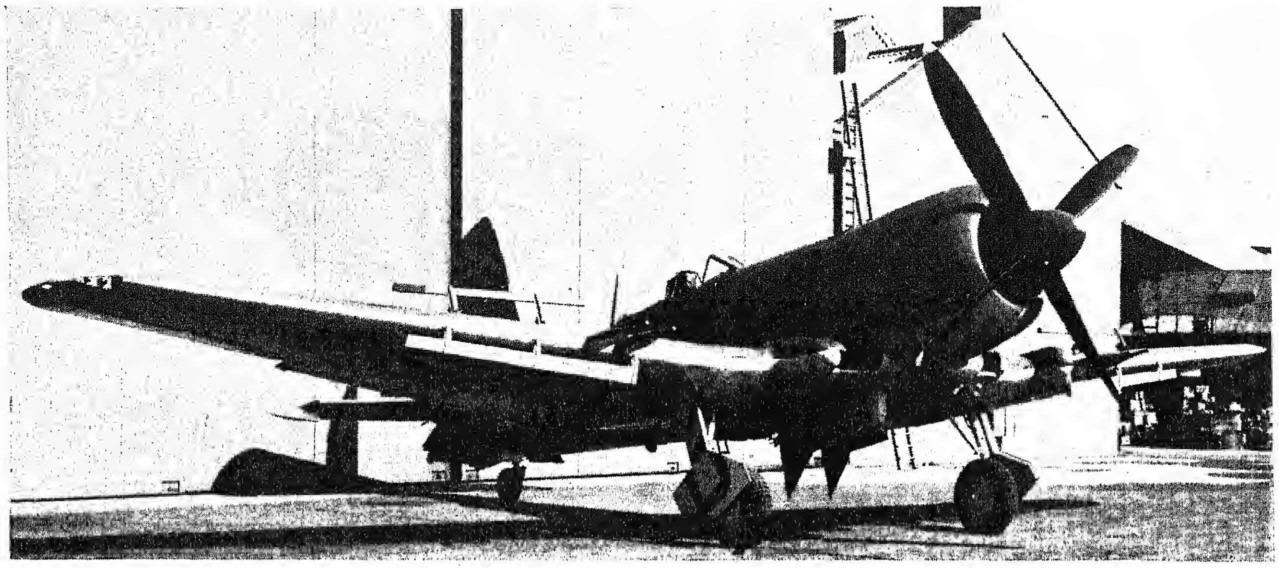
In July, 1946, Blackburn Aircraft, Ltd. formed the North Sea Air Transport Ltd., a charter company with headquarters at the Hanworth Air Park.

THE BLACKBURN B.37 FIREBRAND.

The Firebrand was originally designed as a single-seat Fleet Fighter around the Napier Sabre III 24-cylinder liquid-cooled H-type engine to Specification N.11/40. The first unarmed prototype flew on February 27, 1942, and the Mk. I prototype with full armament and military equipment five months later. At that time the Sabre engine was just going into production and because the Hawker Typhoon was more fully developed than the Firebrand, the Typhoon received priority for the new engine. It was therefore necessary to find an alternative power-plant for the Firebrand and at the same time it was decided to widen its sphere of usefulness by converting it into what is commonly termed a "strike" aircraft, that is, one capable of striking with torpedoes, heavy bombs or rockets and, after release of its load, of operating as an offensive fighter.

The production aircraft, the T.F. Mk. IV, was developed from the Sabre-powered F. Mk. I, which first flew in July, 1942, by way of the T.F. Mk II and the T.F. Mk III. The T.F. Mk. II was the Mk. I arranged as a torpedo-carrier, with slightly increased span, and first flew on March 31, 1943. The T.F. Mk. III was the first Centaurus-powered version, employing either a Mk. VII or a Mk. XI engine, and a Rotol four-blade

BLACKBURN*—continued.*



The Blackburn Firebrand V Single-seat Torpedo-Fighter (2,500 h.p. Bristol Centaurus IX engine).

airscrew. The engine installation and accessories were completely redesigned, and a two-position torpedo-gear, also used latterly on the T.F. Mk. II, was fitted. The T.F. Mk. III first flew on December 21, 1943, and its production version, the T.F. Mk. IV, with re-designed tail surfaces, on May 17, 1945. The T.F. Mk. V is generally similar to the Mk. IV except for minor equipment details and improvements. The following description applies specifically to the T.F. Mk. IV.

Type.—Single-seat Torpedo-carrier and Fleet Fighter.

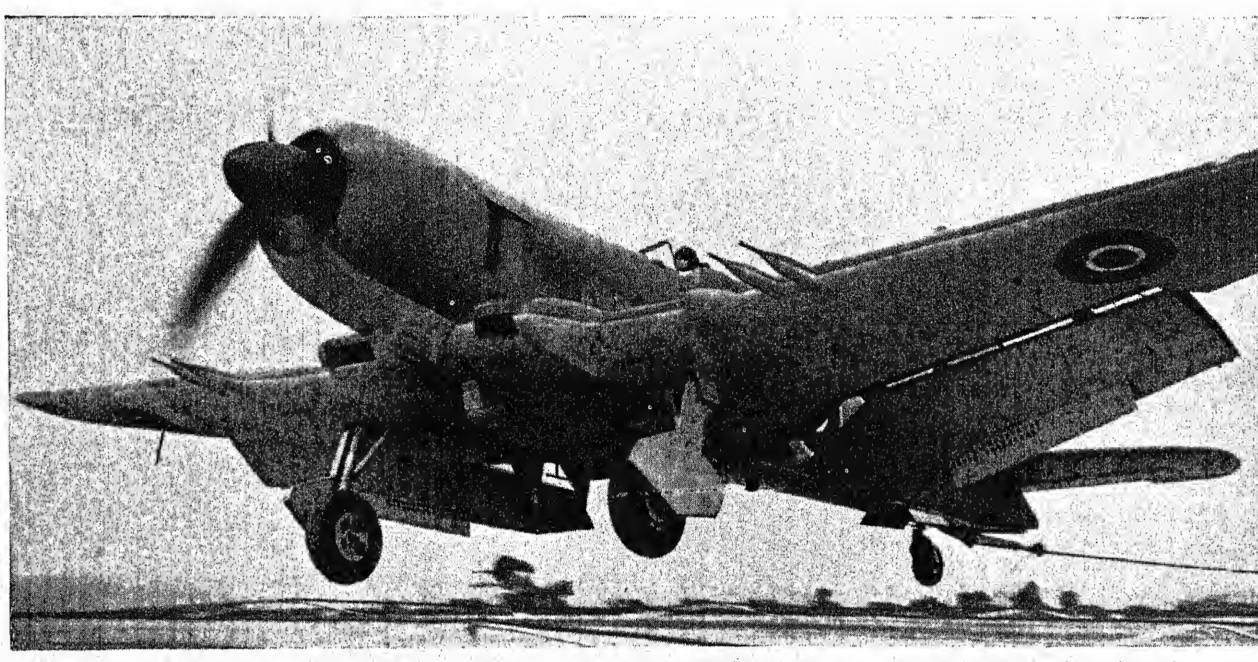
Wings.—Low-wing cantilever monoplane. All-metal two-spar structure consisting of centre-section, two outer panels and detachable tips. Spars composed of hollow extruded booms joined on front and rear faces with plate webs. Spars interconnected by diaphragm ribs, with heavy double frame on centre-line to take main torpedo load. Spanwise tubular stringers on upper surfaces. Stressed skin covering. Outer wing panels fold upwards and backwards round rear spar to lie alongside fuselage. Manual operation. All-metal Frise ailerons with spring servo-tabs. Fowler-type slotted trailing-edge flaps inboard of ailerons and running on rails enclosed completely within wing section. Maximum depression angle 30 degrees. Small automatically-operated supplementary split flap on each main flap depressing 44 degrees. Two small split flaps on centre-section supplement the main flaps. Hydraulic operation by Lockheed gear. Dive-brakes on upper and lower surfaces of outer wings attached to front spar limit dive to 370 m.p.h. (595 km.h.). Main wing root chord 9 ft. 6 in. (2.9 m.), tip chord 4 ft. 3 in. (1.3 m.). Dihedral (outer wings) 5 degrees (on top surface of front spar.). Nett wing area 353.6 sq. ft. (32.85 sq. m.), Gross wing area 381.5 sq. ft. (35.44 sq. m.).

Fuselage.—All-metal structure in two portions jointed at bulkhead behind cockpit. Circular-section forward portion is a tubular structure assembled on a chassis of extruded channel-section members, braced by channel members and plating and covered by detachable metal panels. Rear section is a metal monocoque of oval section.

Tail Unit.—Cantilever monoplane type. All-metal structure with smooth metal covering on all surfaces. Forwardly-placed fin and rudder. Trim-tab at top and spring servo-tab at bottom of horn-balanced rudder. Inset one-piece elevator with trim-tabs at outer ends and spring servo-tabs immediately inboard. Fin offset 3 degrees to starboard. Tailplane span 16 ft. 10 ins. (5.1 m.), tailplane and elevator chord (on centre-line) 5 ft. 10 in. (1.8 m.).

Landing Gear.—Retractable type. Lockheed oleo-pneumatic legs attached to diagonally-braced cast frames at extremities of centre-section between spars. Inwards retraction. Fairing plates attached to each leg and hinged plates below fuselage completely house undercarriage when retracted. Fully-castering self-centering tail-wheel carried on oleo-pneumatic shock-absorber strut which retracts forward into fuselage. Automatically-operated enclosure doors. Hydraulic operation by Lockheed gear with emergency hand-operated pump. Deck arrester hook attached aft of tail-wheel. Track 11 ft. 0½ in. (3.37 m.).

Power Plant.—One 2,500 h.p. Bristol Centaurus IX eighteen-cylinder sleeve-valve air-cooled radial engine driving a Rotol four-blade constant-speed airscrew 13 ft. 3 in. (4 m.) diameter. Main and auxiliary self-sealing fuel tanks in fuselage with total capacity of 239 Imp. gallons (1,187 litres). Oil tank in fuselage behind engine bulkhead. Jettisonable auxiliary fuel tanks of various sizes, up to a maximum capacity of 100 Imp. gallons (455 litres) each, may be carried on wing bomb-racks and on the torpedo beam. Carburettor intake in port extended centre-section, oil-cooler in similar position to starboard. Jettisonable rocket-assisted take-off gear.



A Blackburn Firebrand IV (2,500 h.p. Bristol Centaurus IX engine) landing on the deck of an aircraft-carrier.

BLACKBURN—*continued.*

ACCOMMODATION.—Pilot's cockpit over trailing-edge of wing. Sliding blister-type canopy with bullet-proof windscreen. Armour plating behind and below pilot. Metal decking round cockpit of heavy gauge with good deflection qualities.

ARMAMENT.—Four 20 m/m. Hispano cannon, two in each outer wing on hinged mountings for ease of servicing. Access panel in underside of each wing. Ammunition boxes in outer wings and protected from ahead by armour plating. One 1,850 lb. (840 kg.) torpedo on Blackburn two-position mounting below fuselage. Mounting automatically lowers tail of torpedo to horizontal position when landing-gear is retracted. One 1,000 lb. (454 kg.) bomb may be carried under each wing, a rack being fitted on each gun compartment access door. Racks for Rocket Projectiles below outer wings.

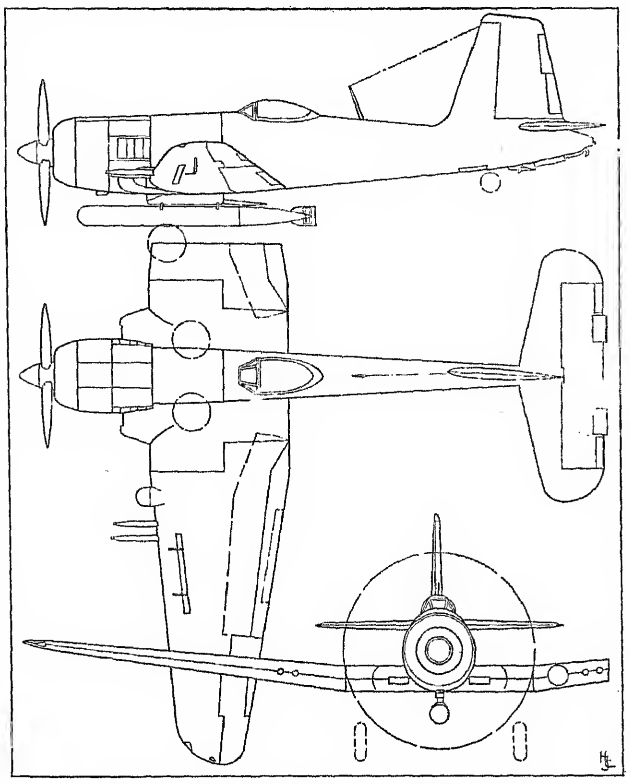
EQUIPMENT.—Full equipment includes radar, radio, camera gun, torpedo camera (in leading-edge of port wing), oxygen apparatus, windscreen de-icing, signals and fire-extinguisher. 24-volt electric system.

DIMENSIONS.—Span 51 ft. 3½ in. (15.62 m.), Length 39 ft. 1 in. (12 m.), Height 15 ft. 2 in. (4.65 m.).

WEIGHTS AND LOADINGS.—Weight empty 11,357 lbs. (5,152 kg.), Normal take-off weight 15,671 lbs. (7,106 kg.), Maximum weight (maximum fuel) 16,227 lbs. (7,361 kg.), Wing loading 41.7 lbs./sq. ft. (203.6 kg./sq. m.), Power loading 6.37 lbs./h.p. (2.88 kg./h.p.).

PERFORMANCE (At 15,671 lbs. = 7,106 kg.).—Maximum speed 334 m.p.h. (537 km.h.) at 12,500 ft. (3,810 m.) in S gear, Speed at sea level 305 m.p.h. (490 km.h.), Speed at 2,500 ft. (760 m.) 316 m.p.h. (511 km.h.) in M gear, Maximum economic cruising speed 280 m.p.h. (450 km.h.) at 10,000 ft. (3,050 m.), Cruising speed at 75% maximum economic power at 10,000 ft. (3,050 m.) 248 m.p.h. (399 km.h.), Rate of climb at sea level 2,100 ft./min. (640 m./min.), Rate of climb at 10,000 ft. (3,050 m.) 1,650 ft./min. (503 m./min.), Service ceiling 29,000 ft. (8,850 m.), Still-air range (at maximum economic cruising speed) 405 miles (651 km.) (1.5 hrs.), Still-air range (with full permanent tankage and torpedo, at maximum economic cruising speed) 600 miles (965 km.) (2.2 hrs.), Still-air range (with three 100 Imp. gallon = 455 litre drop-tanks, at maximum economic cruising speed) 1,480 miles (2,380 km.) (5.4 hrs.), Recommended approach speed (with flaps down and full torpedo load) 95-100 m.p.h. (153-161 km.h.).

PERFORMANCE (Mk. V, at 16,100 lbs. = 7,303 kg.).—Maximum speed 350 m.p.h. (563 km.h.), Maximum speed with torpedo 342 m.p.h. (550 km.h.), Initial rate of climb 2,600 ft./min. (793 m./min.), Initial rate of climb with torpedo 2,200 ft./min. (671 m./min.), Range (at 289 m.p.h. = 465 km.h.) 627 miles (1,009 km.), Range (at 256 m.p.h. = 412 km.h.) 745 miles (1,199 km.).



The Blackburn Firebrand IV Torpedo-Fighter.

BOULTON PAUL.

BOULTON PAUL AIRCRAFT, LTD.

HEAD OFFICE, WORKS AND AERODROME: WOLVERHAMPTON.
Incorporated: June, 1934.
Chairman: R. G. Simpson.
Directors: J. D. North, F.R.Ae.S., M.I.Ae.E., F.R.Met. Soc. and N.R. Adshead (Joint Managing), J. Kissane and R. Beasley.
Chief Designer (Aircraft): J. W. Batchelor.

Boulton Paul Aircraft, Ltd. was formed in 1934 to take over the old-established Aircraft Department of Boulton & Paul, Ltd., together with one-third of the issued capital of A.T.S. Ltd., which company was incorporated in 1931 to hold a large number of patents relating to metal construction pooled by the following aircraft companies:—Boulton & Paul Ltd., Gloster Aircraft Co. Ltd., Sir W. G. Armstrong Whitworth Aircraft Ltd., and the Steel Wing Co. Ltd.

During 1936 Boulton Paul Aircraft Ltd., moved its works from Norwich to a new factory at Wolverhampton.

The only Boulton Paul design produced in quantity during the war was the Defiant two-seat night-fighter, full particulars of which have been given in previous issues of "All the World's Aircraft."

Brief details of an interesting turret fighter designed by the company during the war, and a half-scale flying model of this aircraft which was built by Heston Aircraft, Ltd are given below.

The Company has also designed and produced large quantities of mechanically-operated gun-turrets of various types.

THE BOULTON PAUL P.108.

The P.108 is a two-seat side-by-side trainer which was, at the time of writing, under construction. It will be fitted with a Rolls-Royce Dart gas-turbine driving a constant-speed tractor airscrew and providing additional jet thrust, the jet outlet being under the fuselage immediately aft of the trailing-edge and offset to starboard to counteract airscrew torque. The P.108 will be suitable for day and night advanced flight training, gunnery, navigation and bombing instruction, and glider-towing.

The P.108 will have upward folding wings, a two-wheel retractable landing-gear and a totally-enclosed cockpit.

DIMENSIONS.—Span 39 ft. 4 in. (11.98 m.), Width folded 21 ft. 1 in. (6.24 m.), Length 34 ft. 4 in. (10.46 m.), Height 11 ft. 10 in. (3.60 m.).

THE BOULTON PAUL P.92.

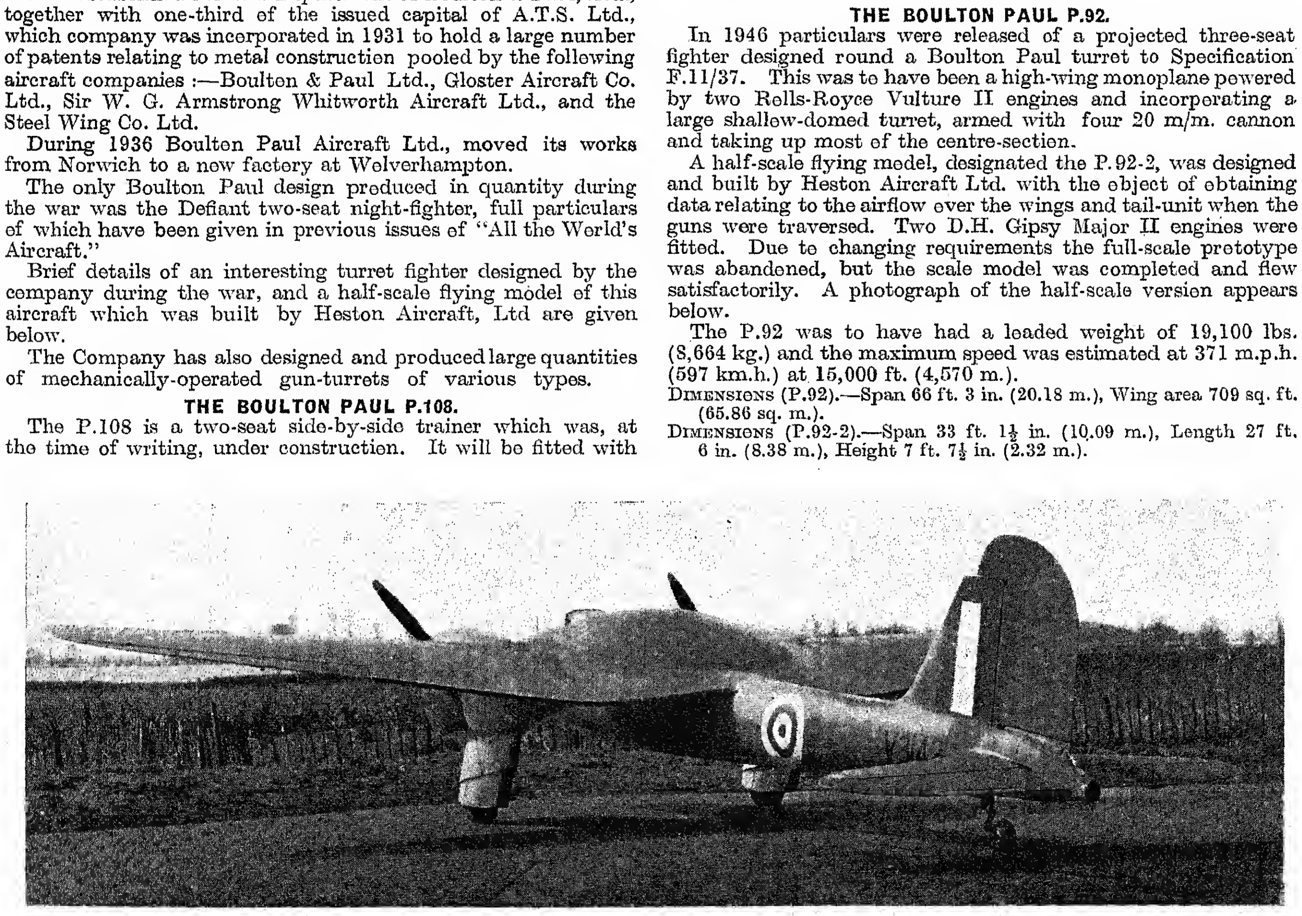
In 1946 particulars were released of a projected three-seat fighter designed round a Boulton Paul turret to Specification F.11/37. This was to have been a high-wing monoplane powered by two Rolls-Royce Vulture II engines and incorporating a large shallow-domed turret, armed with four 20 m/m. cannon and taking up most of the centre-section.

A half-scale flying model, designated the P.92-2, was designed and built by Heston Aircraft Ltd. with the object of obtaining data relating to the airflow over the wings and tail-unit when the guns were traversed. Two D.H. Gipsy Major II engines were fitted. Due to changing requirements the full-scale prototype was abandoned, but the scale model was completed and flew satisfactorily. A photograph of the half-scale version appears below.

The P.92 was to have had a loaded weight of 19,100 lbs. (8,664 kg.) and the maximum speed was estimated at 371 m.p.h. (597 km.h.) at 15,000 ft. (4,570 m.).

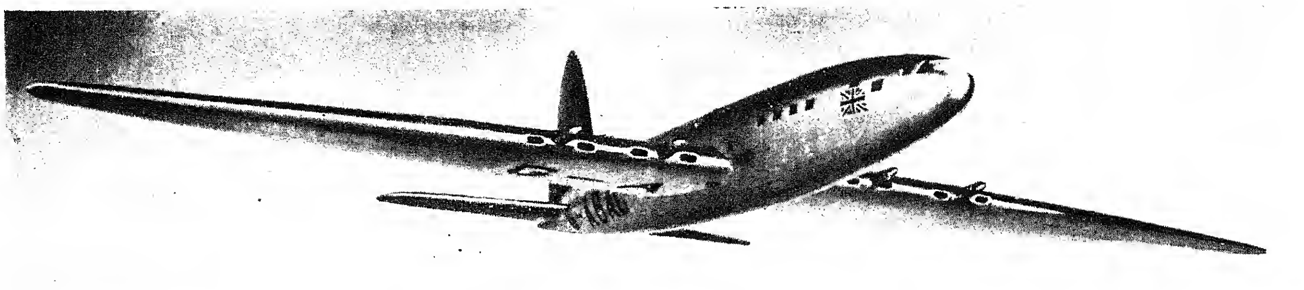
DIMENSIONS (P.92).—Span 66 ft. 3 in. (20.18 m.), Wing area 709 sq. ft. (65.86 sq. m.).

DIMENSIONS (P.92-2).—Span 33 ft. 1½ in. (10.09 m.), Length 27 ft. 6 in. (8.38 m.), Height 7 ft. 7½ in. (2.32 m.).



The Boulton Paul P.92-2, a half-scale flying model of the F 11/37 Fighter Monoplane which was built by Heston Aircraft, Ltd.

BRISTOL.



A model of the Bristol Type 167 Long-range Airliner which is under development.

THE BRISTOL AEROPLANE CO., LTD

Head Office, Works and Aerodrome: Filton, Bristol.
London Office: 6, Arlington Street, St. James's, S.W.1.
Established: 1910.

Directors: Sir William G. Verdon Smith, C.B.E., J.P. (Chairman), Sir G. Stanley White, Bt. (Managing Director), H. J. Thomas (Assistant Managing Director), W. R. Verdon Smith, George S. White, N. Rowbotham and K. J. G. Bartlett (Sales Director).

Chief Designer (Aircraft): A. E. Russell, B.Sc., F.R.Ae.S.

Chief Test Pilot: A. J. Pegg, M.B.E.

Founded in 1910 by the late Sir George White, Bart., pioneer of electric tramways, this company was formerly known as The British and Colonial Aeroplane Co., Ltd.

Throughout the war years Bristol aircraft, powered by Bristol engines, were in constant operational service with all Commands of the Royal Air Force. Details of the Blenheim, Beaufort, Beaufighter and Buckingham were given in previous issues of "All the World's Aircraft".

The total wartime production of Bristol aircraft amounted to over 14,000, including 5,400 Blenheims, 2,200 Beauforts (700 in Australia) and 5,650 Beaufighters (over 250 in Australia).

The Company has since the war produced the Type 170 civilian transport monoplane, which is being supplied to operators at home and overseas, and is engaged in developing the Type 167 110-ton air-liner which conforms to Specification I of the Brabazon Committee.

The Bristol Company has formed a Helicopter Department under the direction of Mr. Raoul Hafner, and a four-seat helicopter, the Type 171, is under development.

Details of the activities of the Aero-engine Division of the Bristol Aeroplane Co., Ltd. will be found in Section D. In addition to the current production of sleeve-valve radial engines the Division is engaged in an extensive programme of gas-turbine development, details of which are also given in Section D.

THE BRISTOL 167.

The Type 167 has been designed to Specification 2/44 as a fully-pressurized long-range passenger monoplane, and the prototype, under construction at Filton, is scheduled to fly in April, 1947. An official order for four Type 167's has been given, the first to be powered by reciprocating engines and the others by gas-turbines driving airscrews.

The Type 167 is an all-metal low-wing monoplane with a constant-chord centre-section and two tapered outer wings with swept-back leading-edges and straight trailing-edges. The power plant of the Mk. I will consist of eight Bristol Centaurus XX eighteen-cylinder two-row radial sleeve-valve air-cooled engines, each developing over 2,500 h.p., buried in the wings and grouped together in pairs to drive two three-blade co-axial contra-rotating tractor airscrews. There will be capacity for 12,000 Imp gallons (54,588 litres) of fuel in the wings. The next three aircraft are to be equipped with Bristol Proteus gas-turbines, and the first of this type, the Mk. II, is expected to fly in 1948.

The wing is a two-spar structure with an EC 1240 (modified) aerofoil section. It has a root chord of 23 ft. 2 in. (7.06 m.) and an aspect ratio of 9.97. Hydraulically-operated plain-hinge flaps are fitted to the trailing-edge and have a total area of 682 sq. ft. (43.35 sq. m.).

The fuselage is a metal monocoque structure of circular cross-section covered with Alclad sheet, and has a maximum external diameter of 17 ft. (5.18 m.). The tail-unit is an all-metal cantilever monoplane structure with a span of 75 ft. (22.86 m.). The landing gear is a retractable tricycle, with twin wheels on the main and nose units. The track is 55 ft. (16.76 m.).

The Type 167 will have a normal crew of ten, and passenger accommodation will be provided for a maximum of 224 passengers by day and 80 by night.

Dimensions.—Span 230 ft. (70.1 m.), Length 177 ft. (53.95 m.), Height 50 ft. (15.24 m.), Gross wing area 5,317 sq. ft. (493.95 sq. m.).

Weights and Loadings (Designed).—Normal weight loaded 279,000 lbs. (126,552 kg.), Maximum weight loaded 285,000 lbs. (129,271 kg.), Wing loading (normal) 52.4 lbs./sq. ft. (255.8 kg./sq. m.).

Performance (Estimated).—Maximum speed 300 m.p.h. (283 km.h.) at 25,000 ft. (7,620 m.), Cruising speed 250 m.p.h. (402 km.h.) at 25,000 ft. (7,620 m.), Stalling speed 95 m.p.h. (153 km.h.).

THE BRISTOL 170 WAYFARER/FREIGHTER.

The Type 170 was designed as an economic passenger or freight transport to carry a high payload on short-range flights. It has a capacious fuselage and, apart from its civil applications, is available as a military transport aircraft and as such can carry a great variety of loads composed of heavy trucks, guns, stretchers, etc. Large twin nose-doors facilitate loading of cargo into the freighter versions. As a military aircraft the Type 170 can be loaded up to a maximum of 39,500 lbs. (17,917 kg.).

The prototype 170 first flew on December 2, 1945. The 170 is now in full production and deliveries are being made to operators all over the World.

The passenger version, which does not have the large nose-doors, is known as the Wayfarer, and the cargo version as the Freighter.

The main versions are:—

Freighter Mk. I. Cargo version with twin nose-doors.

Freighter Mk. IA. Combined cargo/passenger version accommodating 16 passengers in the rear and cargo hold forward. Twin nose-doors.

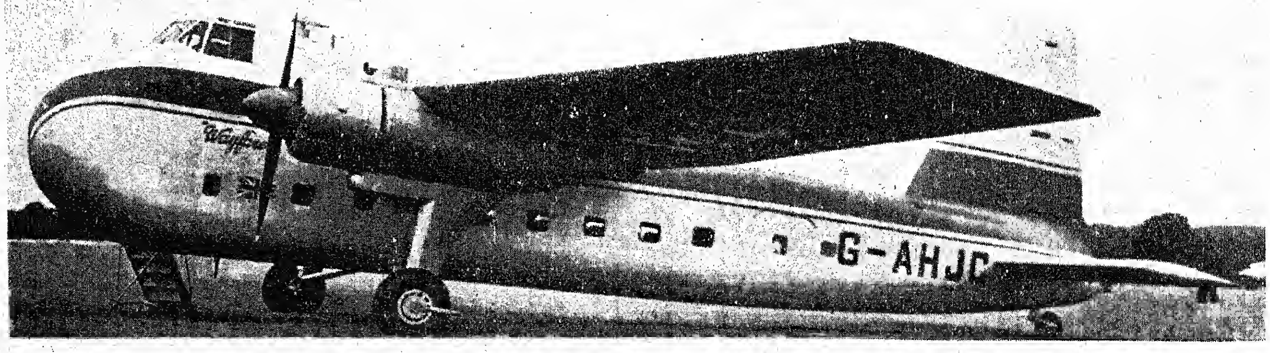
Freighter Mk. II. Cargo version without nose-doors but with large loading door on each side of fuselage.

Wayfarer Mk. IIA. 32-36 Passenger version.

Wayfarer Mk. IIC. Combined passenger/cargo version with accommodation for 20 passengers and cargo stowage fore and aft.

Type.—Twin-engined Passenger (Wayfarer) or Freight (Freighter) Transport.

Wings.—Cantilever high-wing monoplane. Aerofoil section R.A.F. 28 (modified) with thickness/chord ratio of 17.5% at root decreasing to 15% at tip. All-metal two-spar structure consisting of constant-chord centre-section and two straight-tapered outer wings with detachable tips, Centre-section span 31 ft. 2 in. (9.50 m.). Spars are parallel in centre-section and swept-back and converging in outer sections, and are built up of heavy extruded booms



The Bristol 170 Wayfarer (two Bristol Hercules 131 engines).

BRISTOL—*continued.*

joined by stiffened diaphragm webs with, in centre-section, diaphragm ribs spaced by intermediate contour members acting as stiffeners. Reinforced diaphragm ribs at engine mounting points. Girder-type channel-section ribs in outer wing sections, with diaphragm ribs at wing joints and aileron hinge points. Spanwise stringers, and stressed light alloy covering. Gross wing area 1,405 sq. ft. (126.9 sq. m.). All-metal constant-chord Frise ailerons with fabric covering and controllable trim-tab in each. Aileron span 19 ft. 5¾ in. (5.94 m.); chord 2 ft. (0.61 m.); aileron area (each) 54.32 sq. ft. (5.04 sq. m.); aileron movement 17 degrees up, 10 degrees down. Tab span 6 ft. 11 in. (2.11 m.); chord 6¼ in. (15.9 c/m.); tab area 2 sq. ft. (0.186 sq. m.); tab movement 15 degrees up, 15 degrees down. Hydraulically-operated all-metal split trailing-edge flaps in two sections each side between ailerons and fuselage. Outer flap span 12 ft. 4.125 in. (3.76 m.); inner flap span 9 ft. 5.45 in. (2.87 m.); chord (inner and outer) 2 ft. 6 in. (0.76 m.); total flap area 106.5 sq. ft. (9.88 sq. m.). Flap positions 20 degrees for take-off; 60 degrees for landing.

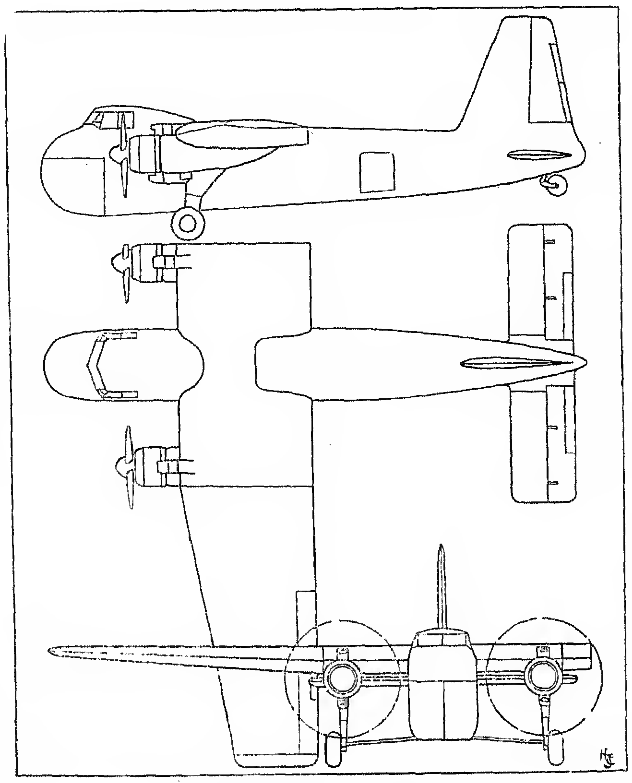
FUSELAGE.—All-metal structure of roughly rectangular cross-section built in two main sections. Structure consists of vertical frames each built up of four standard pressed corner pieces joined by straight lengths of channel-section; continuous longitudinal stringers and stressed Alclad skin. Main floor of extruded light-alloy T-section beams, and channel-section intercostals with covering of detachable wooden panels. On Freighter nose-section is split on vertical centre-line and hinged to open for loading.

TAIL UNIT.—All-metal cantilever monoplane type. Tailplane is constant-chord structure with two spars, chordwise ribs and stressed metal covering. Fin similarly built with swept-back front and rear spars. Rudder and elevators have metal frames and fabric covering and are statically-balanced. Rudder fitted with controllable spring and trim-tabs, and elevators with spring-tab in port and trim-tab in starboard. Tailplane span 17 ft. (5.18 m.); tailplane and elevator chord 8 ft. (2.44 m.); tailplane area 162.32 sq. ft. (15.06 sq. m.); elevator chord 3 ft. 4.8 in. (1.04 m.), elevator area (each) 47.9 sq. ft. (4.45 sq. m.); elevator movement 30 degrees up, 20 degrees down; elevator tab span 8 ft. 1½ in. (2.46 m.); tab area (each) 6.49 sq. ft. (0.64 sq. m.); elevator spring-tab movement 15 degrees up, 20 degrees down; elevator trim-tab movement 20 degrees up, 20 degrees down. Fin area 121.57 sq. ft. (12.1 sq. m.): rudder area 51.15 sq. ft. (4.75 sq. m.); rudder movement 25 degrees each way; rudder trim-tab span 4 ft. 8 in. (1.42 m.); area 3.63 sq. ft. (0.337 sq. m.); movement 6½ degrees each way; rudder spring-tab span 4 ft. 8½ in. (1.43 m.); area 3.65 sq. ft. (0.339 sq. m.); movement 6½ degrees each way.

LANDING GEAR.—Fixed two-wheel type. Each main wheel (Dunlop 48 × 18.00-18) carried on Dowty liquid-spring shock-absorber leg attached to front spar with rear bracing strut and faired strut meeting fuselage. Tyre pressure 50 lbs./sq. in. (3.5 kg./sq. c/m.). Dunlop pneumatic brakes operating at pressure of 150 lbs./sq. in. (10.5 kg./sq. c/m.). Track 27 ft. 4 in. (8.54 m.); wheel base (tail down) 56 ft. 5.6 in. (17.24 m.). Castering tail-wheel carried in fork on Dowty liquid-spring shock-absorber unit.

POWER PLANT.—Two Bristol Hercules 131 fourteen-cylinder two-row radial sleeve-valve air-cooled engines fitted with single-speed superchargers, and each rated at 1,690 h.p. for take-off. Engines mounted on quickly-detachable bearers and enclosed in long-chord cowlings with controllable trailing-edge cooling gills. Engine centres 25 ft. (7.62 m.). Rotol or de Havilland four-blade constant-speed full-feathering metal airscrews, 13 ft. 3 in. (4.04 m.) diameter. Two 300 Imp. gallon (1,364 litre) riveted alloy fuel tanks, in centre-section, one on each side of fuselage between spars. Each tank divided into two compartments with separate filler, gauge, etc. Provision for additional 900 Imp. gallon (4,091 litre) fuel tank in fuselage. Oil capacity 39 Imp. gallons (177 litres).

ACCOMMODATION (Freighter Mk. I).—Crew of two accommodated in flight compartment at top of forward section of fuselage, reached *via* hatch in floor and ladder on starboard wall of main freight hold. Pilot (on port) and co-pilot/radio-operator seated side-by-side with dual controls. V-windscreen. Main cargo hold is 35 ft. long × 8 ft. wide × 6 ft. 8 in. high (9.65 m. × 2.44 m. × 2.03 m.) with volume of 2,020 cub. ft. (57.2 cub. m), and extends from nose to stressed bulkhead aft of wing trailing-edge. Floor is 4 ft. 6 in. (1.37 m.) from ground and may be loaded up to 75 lbs./sq. ft. (366 kg./sq. m.). Two strengthened strips run longitudinally along floor to permit heavy vehicles to be carried, and may be loaded up to 200 lbs./sq. ft. (976 kg./sq. m.). Tying-down points in floor. Mechanically-operated twin nose doors permit direct loading of freight from floor of truck, etc. and allow vehicles to be driven in *via* a ramp. At rear of main hold is smaller freight compartment 8 ft. 4 in. long × 8 ft. wide × 6 ft. 8 in. high (2.54 m. × 2.44 m. × 2.03 m.) with volume of 340 cub. ft. (9.6 cub. m.), with door 6 ft. 4 in. high × 4 ft. wide (1.83 m. × 1.22 m.) in bulkhead. Door 2 ft. 8 in. (0.81 m.) from ground on port side of fuselage, 5 ft. high × 4 ft. 2 in. wide (1.52 m. × 1.27 m.) for loading rear compartment.

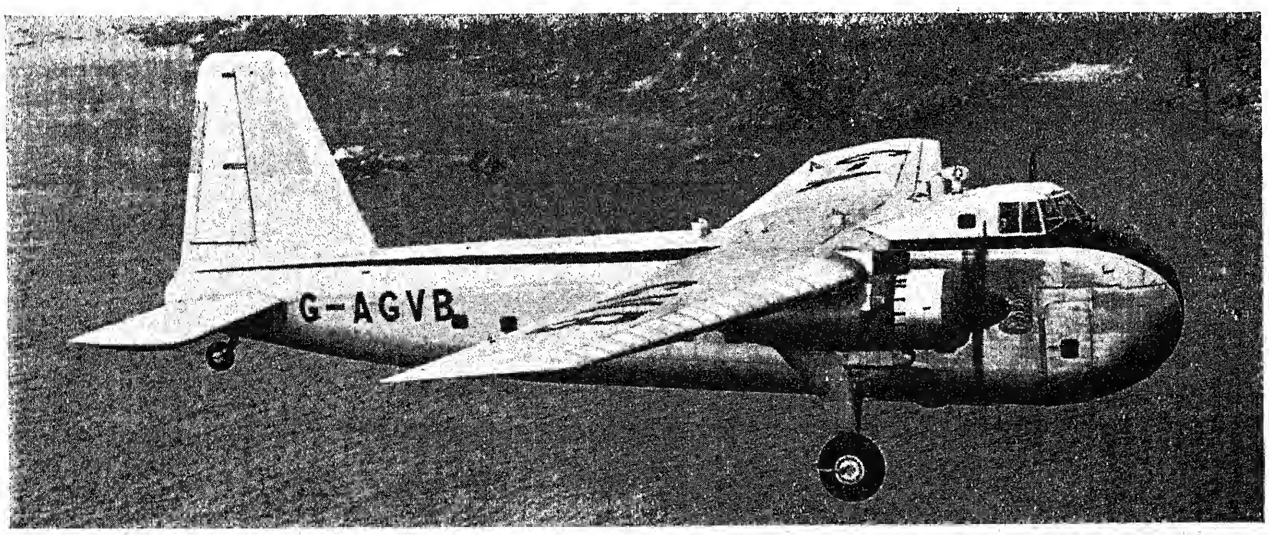


The Bristol 170 Freighter.

ACCOMMODATION (Freighter Mk. II).—Similar to Mk. I but without large nose doors. Large access door on each side of fuselage.

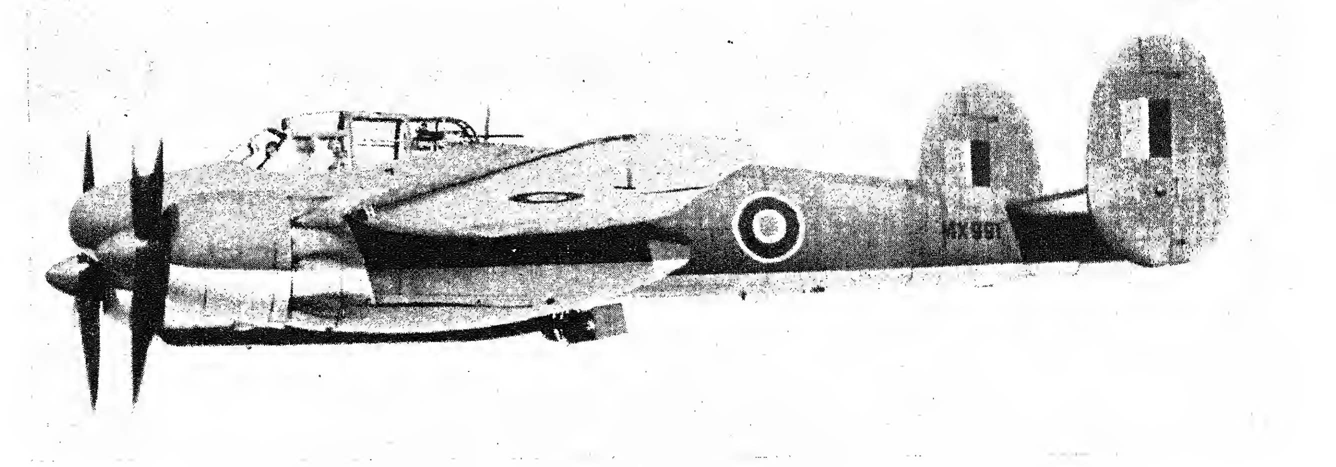
ACCOMMODATION (Wayfarer Mk. IIA).—Crew compartment as Freighter Mk. I but with provision for pilot, co-pilot, radio-operator and steward. Under rear of flight deck is buffet, with sliding door 6 ft. 1 in. high × 2 ft. 3 in. wide (1.85 m. × 0.69 m.) into main cabin. Main cabin accommodates 32 passengers in two rows of eight double seats with central gangway, and provision for installing two further double seats in entrance lobby at rear. Main access door 5 ft. 2 in. high × 4 ft. 2 in. wide (1.57 m. × 1.27 m.) on port side of fuselage in entrance lobby. Toilet compartment on port side at rear of entrance door. Racks for personal luggage along each side of main cabin. Luggage compartment forward of buffet with capacity of 165 cub. ft. (4.67 cub. m.). Access door on starboard side of fuselage 6 ft. high × 2 ft. 9 in. wide (1.83 m. × 0.84 m.).

ACCOMMODATION (Wayfarer Mk. IIC).—Crew as Mk. I. Passenger cabin 18 ft. 4 in. long × 8 ft. wide × 6 ft. 8 in. high (5.59 m. ×



The Bristol 170 Wayfarer (two 1,690 h.p. Bristol Hercules 131 engines).

***BRISTOL**—continued.*



The Bristol Brigand Long-range Attack Monoplane (two Bristol Centaurus 57 engines).

2.44 m. × 2.03 m.) extends from bulkhead aft of crew compartment and accommodates 16-20 passengers in double seats on each side. Aft of main cabin is freight hold 10 ft. long × 8 ft. wide × 6 ft. 8 in. high (3.05 m. × 2.44 m. × 2.03 m.). Forward luggage compartment in nose has volume of 280 cub. ft. (8 cub. m.), with access door on starboard side of fuselage. Entrance lobby aft of rear freight hold, with door on port side.

Accommodation (Freighter Mk. IA).—Crew as Mk. I. Freight compartment extends from bulkhead at rear of flight compartment and is 10 ft. 8 in. long × 8 ft. high × 6 ft. 8 in. wide (3.25 m. × 2.44 m. × 2.03 m.). Twin loading doors in nose. Passenger cabin 14 ft. 8 in. long × 8 ft. wide × 6 ft. 8 in. high (4.47 m. × 2.44 m. × 2.03 m.) has accommodation for 16 passengers. Entrance lobby and access door at rear as on Mk. IIC.

Equipment.—24-volt electric system. T.K.S. de-icing system. Janitrol 15,000 BTU cabin heater.

Dimensions.—Span 98 ft. (29.88 m.), Length 68 ft. 4 in. (20.84 m.), Height (tail down, over fin) 21 ft. 8 in. (6.60 m.).

Weights and Loadings (Freighter Mk. I).—Weight empty (equipped. 23,654 lbs. (10,729 kg.), Crew (2) 340 lbs. (154 kg.), Oil (39 Imp. gallons = 177 litres) 350 lbs. (159 kg.), Payload and fuel 12,656 lbs. (5,741 kg.), Weight loaded 37,000 lbs. (16,783 kg.), Wing loading 26 lbs./sq. ft. (126.9 kg./sq. m.), Power loading 10.9 lbs./h.p. (4.94 kg./h.p.).

Weights and Loadings (Freighter Mk. IA).—Weight empty (equipped) 25,114 lbs. (11,392 kg.), Crew (4) 680 lbs. (308 kg.), Oil 350 lbs. (159 kg.), Payload and fuel 10,856 lbs. (4,924 kg.), Weight loaded 37,000 lbs. (16,783 kg.). Loadings as Mk. I.

Weights and Loadings (Freighter Mk. II).—Weight empty (equipped) 23,534 lbs. (10,675 kg.), Crew (2) 340 lbs. (154 kg.), Oil 350 lbs. (159 kg.), Payload and fuel 12,776 lbs. (5,795 kg.), Weight loaded 37,000 lbs. (16,783 kg.), Loadings as Mk. I.

Weights and Loadings (Wayfarer Mk. IIA).—Weight empty (equipped) 26,139 lbs. (11,857 kg.), Crew (4) 680 lbs. (308 kg.), Oil 350 lbs. (159 kg.), Payload and fuel 9,831 lbs. (4,459 kg.), Weight loaded 37,000 lbs. (16,783 kg.). Loadings as Mk. I.

Weights and Loadings (Wayfarer Mk. IIC).—Weight empty (equipped) 25,959 lbs. (11,775 kg.), Crew (4) 680 lbs. (308 kg.). Oil 350 lbs. (159 kg.), Payload and fuel 10,011 lbs. (4,541 kg.), Weight loaded 37,000 lbs. (16,783 kg.). Loadings as Mk. I.

Performance (At 37,000 lbs. = 16,783 kg.).—Maximum speed 221 m.p.h. (356 km.h.) at 5,000 ft. (1,525 m.), Maximum weak mixture cruising speed 194 m.p.h. (311 km.h.) at 5,000 ft. (1,525 m.), Recommended weak mixture cruising speed 153 m.p.h. (246 km.h.) at 5,000 ft. (1,525 m.), Stalling speed (with flaps) 73 m.p.h. (117 km.h.), Initial rate of climb 970 ft./min. (295 m./min.), One-engine initial rate of climb 200 ft./min. (61 m./min.), Rate of climb at 5,000 ft. (1,525 m.) 1,040 ft./min. (317 m./min.), One-engine rate of climb at 5,000 ft. (1,525 m.) 115 ft./min. (35 m./min.), Service ceiling 20,000 ft. (6,095 m.), Range (with 32 passengers) 600 miles (966 km.), Range (with 8,950 lbs. = 4,060 kg. freight) 700 miles (1,127 km.), Maximum still-air range 1,085 miles (1,746 km.), Take-off distance to 50 ft. (15 m.) 750 yds. (686 m.), One-engine take-off distance to 50 ft. (15 m.) 1,350 yds. (1,234 m.), Landing distance from 50 ft. (15 m.) 750 yds. (686 m.).

THE BRISTOL 171 HELICOPTER.

The Type 171 is a four-seat civilian helicopter the prototype of which was being built at the time of writing. It is to have a main rotor mounted above the fuselage and a vertical anti-torque rotor carried on the upswept stern. The power plant will consist of a Bristol radial air-cooled engine mounted in the fuselage. No further details, except for the following figures, had been released for publication at the time of closing for press.

Dimensions.—Rotor diameter: 40 ft. 8 in. (12.39 m.), Height 9 ft. 6 in. (2.89 m.).

Weight Loaded (Designed).—4,500 lbs. (2,041 kg.).

THE BRISTOL 164 BRIGAND.

The Brigand is a twin-engined three-seat Long-range Attack aircraft capable of fulfilling the duties of a dive-bomber, torpedo-fighter, mine-carrier or day or night fighter, with correspondingly suitable tankage for all operational requirements. But for the sudden end of hostilities the Brigand was destined to take the place of the Beaufighter in the Pacific theatre of war.

A development of the Buckingham, the Brigand uses wings, landing-gear, engine-nacelles and tail-unit which are similar to those of the Buckingham. An entirely new fuselage of smaller cross-sectional area has accommodation for a pilot, navigator/torpedo operator and radio operator/gunner grouped together in the forward fuselage.

Type.—Twin-engined three-seat Long-range Attack monoplane suitable for dive-bombing, torpedo-carrying, mine-laying or day or night fighting.

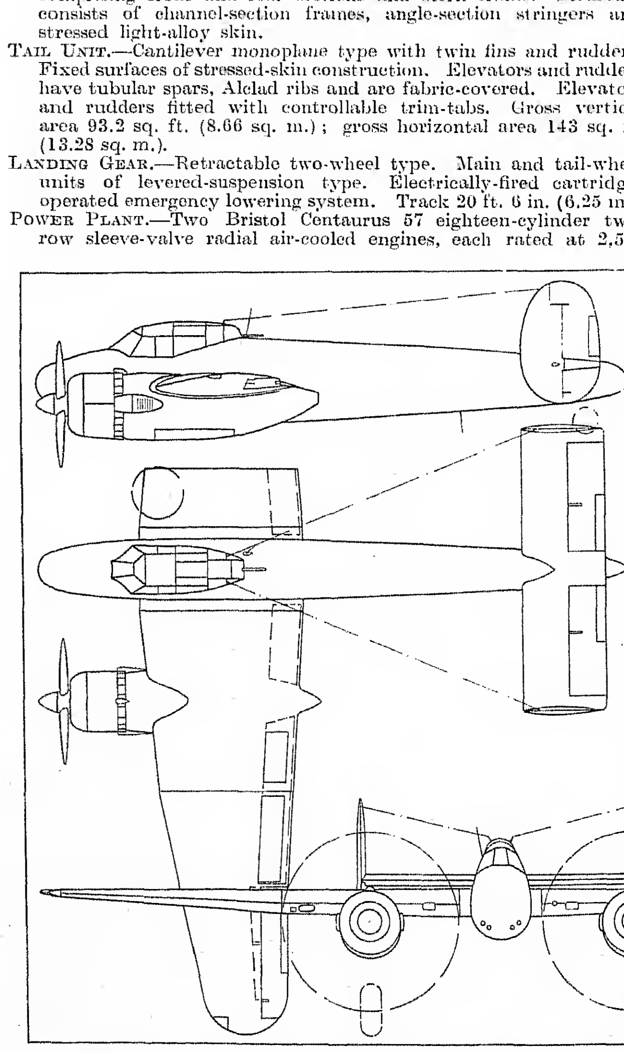
Wings.—Mid-wing cantilever monoplane. Aerofoil section R.A.F. 28 (modified). All-metal two-spar stressed skin structure. Metal-covered Frise-type ailerons with controllable trim-tabs. Hydraulically-operated split flaps in six sections, one on each outer and two on each inner wing section and operated by torsional control tubes. Bellows-type dive brakes above the trailing-edge and on the underside of the split flaps. These are maintained closed by venturi valves and ducts in the leading-edge which cause a reduction in pressure within the bellows. To operate brakes valves are closed by hydraulic jacks and ram pressure then builds up to force bellows open. Gross wing area 718 sq. ft. (66.7 sq. m.).

Fuselage.—Oval section semi-monocoque structure in three portions comprising front and rear sections and stern frame. Structure consists of channel-section frames, angle-section stringers and stressed light-alloy skin.

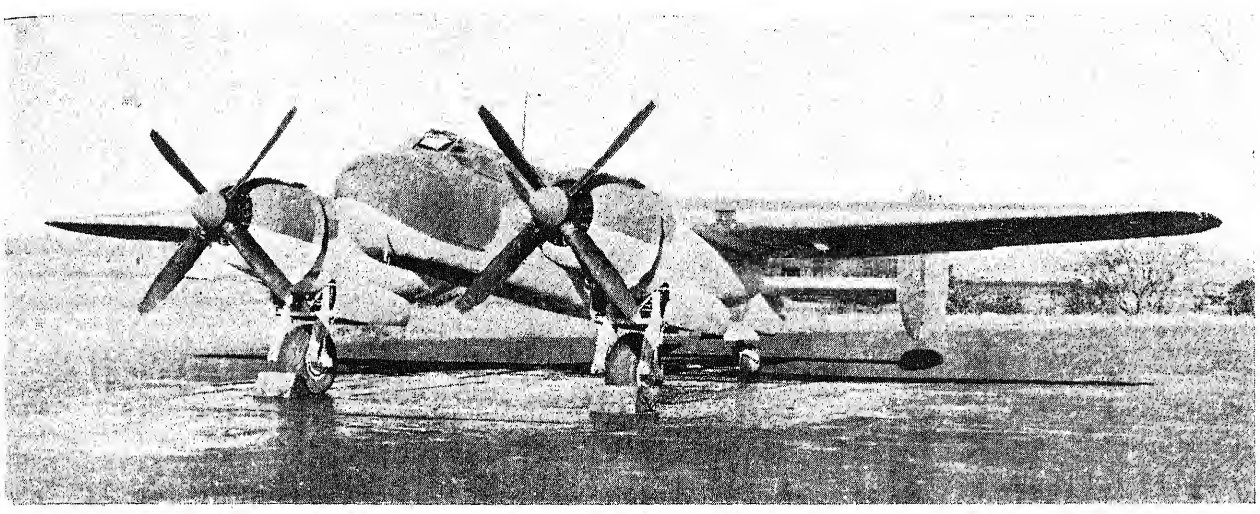
Tail Unit.—Cantilever monoplane type with twin fins and rudders. Fixed surfaces of stressed-skin construction. Elevators and rudders have tubular spars, Alclad ribs and are fabric-covered. Elevators and rudders fitted with controllable trim-tabs. Gross vertical area 93.2 sq. ft. (8.66 sq. m.); gross horizontal area 143 sq. ft. (13.28 sq. m.).

Landing Gear.—Retractable two-wheel type. Main and tail-wheel units of levered-suspension type. Electrically-fired cartridge-operated emergency lowering system. Track 20 ft. 6 in. (6.25 m.).

Power Plant.—Two Bristol Centaurus 57 eighteen-cylinder two-row sleeve-valve radial air-cooled engines, each rated at 2,500



The Bristol Brigand I Long-range Attack Monoplane.



The Bristol Buckmaster Advanced Trainer (two Bristol Centaurus VII engines).

h.p. for take-off ; 2,300 h.p. at 17,000 ft. (5,180 m.) for combat flight ; 2,800 h.p. at low altitudes, and 2,550 h.p. at 13,500 ft. (4,115 m.) with methanol/water injection. Rotol four-blade constant-speed airscrews 14 ft. (4.27 m.) diameter. Close-fitting low-drag cowlings with Rotol cooling fans and electrically-operated trailing-edge gills. Self-sealing fuel tanks in wings, with capacity of 1,058 Imp. gallons (4,813 litres). Total capacity with auxiliary tanks, 1,438 Imp. gallons (6,540 litres).

ACCOMMODATION.—Crew of three comprising pilot, navigator/torpedo operator, and radio operator/gunner in tandem seats under a continuous transparent canopy.

ARMAMENT.—Four 20 m/m. cannon in underside of fuselage and firing through ports under the nose. One flexible .50 in. (12.7 m/m.) machine-gun in rear gunner's position. Torpedo, mine or bombs carried under fuselage, and one bomb or four rocket-projectiles under each wing.

DIMENSIONS.—Span 72 ft. 4 in. (22 m.), Length 46 ft. 5 in. (14.2 m.), Height (tail up, over rudder) 17 ft. 5 in. (5.3 m.).

WEIGHTS AND LOADINGS.—Weight empty 24,627 lbs. (11,171 kg.), Normal weight loaded 38.324 lbs. (17,384 kg.), Maximum weight loaded 39,330 lbs. (17,840 kg.), Wing loading (normal) 53.3 lbs./sq. ft. (260 kg./sq. m.), Power loading (at take-off) 7.66 lbs./h.p. (3.47 kg./h.p.).

PERFORMANCE.—Maximum speed 358 m.p.h. (573 km.h.) at 14,000 ft. (4,270 m.), Maximum weak mixture cruising speed 311 m.p.h. (498 km.h.) at 21,300 ft. (6,500 m.), Initial rate of climb 1,500 ft./min. (458 m./min.), Service ceiling 26,000 ft. (7,930 m.), Climb to service ceiling 33 mins.. Maximum still-air range 2,775 miles (4,466 km.) with auxiliary tanks.

THE BRISTOL 166 BUCKMASTER.

The Buckmaster is a three-seat Advanced Trainer version of the Buckingham with all armament removed and the fuselage widened at the cockpit to permit side-by-side seating.

The power plant consists of two Bristol Centaurus VII engines, each rated at 2,400 h.p. for take-off and driving Rotol four-blade constant-speed airscrews, 14 ft. (4.26 m.) diameter.

The crew of three consists of instructor, pupil-pilot and radio operator. The pilot's cockpit is fitted with complete dual controls, the pupil being seated on the port side. Duplicated controls include those for landing-gear, flaps, airscrews, throttles and brakes. There is an overriding brake control for the instructor's use in an emergency. The radio operator's position is between the main spars with the equipment grouped mainly on the port sido. Night and blind flying equipment, fire-extinguishers, emergency signalling equipment and dinghy are fitted.

DIMENSIONS.—Span 71 ft. 10 in. (21.9 m.), Length 46 ft. 5 in. (14.15 m.).

WEIGHTS AND LOADINGS.—Weight empty (equipped 24,377 lbs. (11,057 kg.), Removable load 1,004 lbs. (456 kg.), Fuel and oil 8,270 lbs. (3,751 kg.), Weight loaded 33,651 lbs. (15,264 kg.), Wing loading 47.6 lbs./sq. ft. (232.4 kg./sq. m.), Power loading at take-off 7.02 lbs./h.p. (3.18 kg./h.p.).

PERFORMANCE.—Maximum speed 352 m.p.h. (563 km.h.) at 12,000 ft. (3,660 m.), Maximum weak mixture cruising speed 325 m.p.h. (520 km.h.) at 18,000 ft. (5,490 m.), Stalling speed 88 m.p.h. (142 km.h.), Initial rate of climb 2.245 ft./min. (684 m./min.), Service ceiling 30,000 ft. (9,150 m.), Maximum range 2,325 miles (3,742 km.).

CHILTON.

CHILTON AIRCRAFT COMPANY LTD.

HEAD OFFICE AND WORKS: CHILTON AIRCRAFT WORKS, HUNGERFORD, BERKS.

Chilton Aircraft Co. Ltd. was registered on June 5, 1946, and is a successor to the former Chilton Aircraft.

Chilton Aircraft was formed in 1936 and its first production was an ultra-light single-seat monoplane fitted with the Carden converted Ford-Ten four-cylinder water-cooled engine of 32 h.p. Chilton Aircraft subsequently took over the stock of Carden Aero-Engines, Ltd., and continued to assemble these engines for their own requirements as well as for various other users.

Another version of the Chilton monoplane fitted with a 40 h.p. Train engine was produced shortly before the outbreak of the late War and this model won the Folkestone Trophy Race in the Summer of 1939.

Another model which was under construction at the outbreak of War was a two-seat cabin monoplane to be powered with any suitable engine of about 90 h.p. Descriptions of these aircraft last appeared in the 1939 issue of "All the World's Aircraft."

Throughout the War Chilton Aircraft was fully engaged on sub-contract work for the Ministry of Aircraft Production. The new company now plans the revival of its interrupted projects, including the manufacture of the Olympia sailplane.

THE CHILTON OLYMPIA SAILPLANE.

The Olympia is a single-seat sailplane of German origin which was produced specifically for the Olympic Games of 1940, subsequently proving to be the most successful design entered.

It is an all-wood structure with a wing of Göttingen 549-676 aerofoil section and a taper ratio of 2.6 : 1.

DIMENSIONS.—Span 49 ft. 3½ in. (15 m.), Length 22 ft. (6.7 m.), Wing area 161 sq. ft. (15 sq. m.).

WEIGHTS AND LOADING.—Weight empty 353 lbs. (160 kg.), Disposable load 209 lbs. (95 kg.), Weight loaded 572 lbs. (255 kg.), Wing loading 3.48 lbs./sq. ft. (17 kg./sq. m.).

PERFORMANCE.—Best gliding angle 25 : 1 at 45 m.p.h. (73 km.h.), Minimum sinking speed 2.2 ft./sec. (0.67 m./sec.) at 39 m.p.h. (63 km.h.), Stalling speed 31 m.p.h. (50.5 km.h.).

CHRISLEA.

CHRISLEA AIRCRAFT CO., LTD.

HEAD OFFICE: HESTON AIRPORT, MIDDLESEX.

WORKS: EXETER AIRPORT, HONITON, DEVON.

Directors: R. C. Christoforides, J. W. Hick and E. E. Christoforides.

The Chrislea Aircraft Co. Ltd. was formed in 1936 to manufacture light aircraft. Its first prototype the L.C.I. Airguard, which was described in the 1939 Edition of this Annual was completed in 1938 and this aircraft was undergoing flight tests when the war broke out. The company then abandoned all private work and went over to component manufacture for military aircraft.

The Company has now produced a light four-seat cabin monoplane known as the Ace, series production of which was scheduled to begin at a new factory at Exeter Airport, Honiton, Devon, in 1947.

The prototype Ace (C.H.3 Series I) was fitted with a single fin and rudder and a wooden wing, and first flew at Heston on August 19, 1946. It was subsequently fitted with twin fins and rudders (C.H.3 Series II). The production version (C.H.3 Series III) will have a metal wing and the following description refers to this model.

THE CHRISLEA C.H.3 ACE.

TYPE.—Four-seat Cabin Monoplane.

WINGS.—Strut-braced high-wing monoplane. Aerofoil section NACA 23012. Constant-chord two-spar structure. Spars have tubular steel booms with tubular bracing ; pressed aluminium ribs ; light-alloy leading-edge and fabric covering aft. Detachable tips. Steel-tube V-struts on each side brace wings to lower longerons. Incidence 3¾ degrees ; dihedral 1¾ degrees ; chord 5 ft. 0 in. (1.52 m.) ; nett wing area 146 sq. ft. (13.55 sq. m.) ; gross wing area 165 sq. ft. (15.32 sq. m.). Metal ailerons with metal covering. Aileron span 7 ft. 11 in. (2.41 m.) ; aileron chord 10.4 in. (26.4 c/m.) ;

CHRISLEA—*continued.*

The Chrislea C.H.3 Ace Two-seat Light Monoplane (125 h.p. Lycoming engine).

aileron area (each) 6.86 sq. ft. (0.64 sq. m.). All-metal split trailing-edge flaps between ailerons and fuselage.

FUSELAGE.—Steel-tube structure with light wooden formers and stringers. Metal covering from engine bulkhead to front of cabin doors, and metal-covered rear deck. Sides and bottom fabric-covered. Maximum width 3 ft. 11 in. (1.19 m.).

TAIL UNIT.—Strut-braced tailplane mounting twin fins and rudders as endplates. All-metal structure. Tailplane has single light-alloy spar; pressed light-alloy ribs and metal skin. Variable incidence tailplane operated by screw-jack on spar. Tailplane span 9 ft. 10 in. (3 m.); tailplane and elevator chord 2 ft. 6 in. (0.86 m.); tailplane and elevator area 24.1 sq. ft. (2.24 sq. m.); fin and rudder area (each) 5.15 sq. ft. (0.94 sq. m.).

LANDING GEAR.—Fixed tricycle type. Main wheels 14 in. (35.5 c/m.) diameter each carried on single cantilever rubber-tension shock-absorber leg. Nose-wheel carried in fork on similar leg is castering 30 degrees. Track 6 ft. 0 in. (1.83 m.); wheel base 5 ft. 8 in. (1.73 m.). Bendix differential toe-operated brakes on main wheels.

POWER PLANT.—One 125 h.p. Lycoming O-290 four-cylinder horizontally-opposed air-cooled engine driving Weybridge two-blade fixed-pitch wooden airscrew, 6 ft. 0 in. (1.83 m.) diameter. Normal fuel capacity 16.5 Imp. gallons (75 litres) in tank behind engine bulkhead. Maximum fuel capacity (three-seat version) 38.5 Imp. gallons (175 litres). Oil capacity 2 Imp. gallons (9 litres).

ACCOMMODATION.—Enclosed cabin seating four in two pairs; two single seats side-by-side in front and full-width seat behind. Moulded Perspex windscreen and rear and roof windows. Access door of steel-tube framework and wooden covering on each side of fuselage. Sliding Perspex windows. Cabin interior width 3 ft. 6 in. (1.17 m.). Chrislea control system consisting of single column projecting from ball-mounting on dashboard with wheel for aileron control; up and down movement for longitudinal control and left and right movement for rudder control. Dual controls, either set removable.

DIMENSIONS.—Span 34 ft. 0 in. (10.36 m.), Length 21 ft. 0 in. (6.40 m.); Height overall 7 ft. 3 in. (2.21 m.).

WEIGHTS AND LOADINGS (Designed).—Weight empty 1,040 lbs. (472 kg.), Pilot and three passengers 680 lbs. (308 kg.); Fuel and oil 145 lbs. (66 kg.); luggage 85 lbs. (38 kg.), Weight loaded 1,950 lbs. (884 kg.), Wing loading 11.8 lbs./sq. ft. (57.6 kg./sq. m.), Power loading 15.6 lbs./h.p. (7 kg./h.p.).

PERFORMANCE (Estimated, at 1,950 lbs.=884 kg.).—Maximum speed 127 m.p.h. (204 km.h.), Cruising speed at 2,200 r.p.m. at sea level 116 m.p.h. (187 km.h.), Stalling speed 45 m.p.h. (72 km.h.), Rate of climb 720 ft./min. (220 m./min.), Normal range 290 miles (467 km.), Maximum range 650 miles (1,046 km.), Take-off distance to 50 ft. (15 m.) 250 yds. (228 m.), Landing distance from 50 ft. (15 m.) 167 yds. (153 m.), Fuel consumption (cruising) 6.25 Imp. gallons (28.4 litres) per hour.

CIERVA.

THE CIERVA AUTOGIRO COMPANY, LTD.

HEAD OFFICE: SOUTHAMPTON AIRPORT, SOUTHAMPTON, HAMPSHIRE.

Directors: J. G. Weir, C.M.G., C.B.E., The Hon. H. K. M. Kindersley. Harold F. Pitcairn (American), and C. G. Pullin, M.I.A.E., A.F.R.Ae.S., M.H.A. (Managing Director).

Secretary: W. G. Leslie.

Chief Mechanical Engineer: K. Watson.

Senior Technical Officer: J. S. Shapiro.

Design and Stress: H. Bolas.

The Cierva Autogiro Company was formed on March 24, 1926, and has specialised in the design of various models of the Autogiro, the gyroplane invented by the late Senor Juan de la Cierva. The best-known version was the C.30A, the prototype of which appeared in 1933. This Autogiro was used in small numbers by the R.A.F. as the Rota, and was constructed under licence by A. V. Roe & Co. Ltd. A later design also used by the R.A.F. was the C.40 two-seat Autogiro, which was described in the 1939 Edition of "All the World's Aircraft."

The Company has conducted experiments in helicopter design, and the W.9 helicopter, a joint production of the Cierva Company and G. & J. Weir, Ltd., uses a jet thrust in place of the orthodox anti-torque tail rotor.

The W.10 Air House triple-rotor helicopter was designed specifically for crop-spraying, and at the time of writing was being constructed under an agreement concluded between the Cierva Company and Cunliffe-Owen Aircraft, Ltd. at the latter's factory at Southampton.

THE CIERVA W.10 AIR HORSE.

The W.10 Air Horse triple-rotor helicopter was designed specifically to the requirements of Pest Control Ltd. for crop-spraying purposes. An ingenious feature is the use made of the slipstream from the rotors to circulate the chemical spray to the undersurfaces of the foliage of the crops.

The W.10 is a large aircraft with two rotors carried on steel-tube outriggers, one on either side of the fuselage, while the third is mounted at the extremity of the upswept stern. The rotors are identical. All rotate in the same direction and the hubs are set at a slight inclination ($3\frac{3}{4}$ degrees) to the axes of the rotor shafts for torque compensation. The hubs are arranged for cyclic and collective pitch control. Rotor drive is by a primary and a secondary transmission, with a gear ratio of 13.7 : 1 between the engine crankshaft and the rotors. Power is supplied by a Rolls-Royce Merlin 32 twelve-cylinder vee liquid-cooled engine mounted in the fuselage. The rotor speed is 175 r.p.m.

The rotor blades are of aluminium and resin-bonded moulded plywood construction, with a Plastoglaze finish.

Lateral control is effected by differential collective pitch of the two front rotors; longitudinal control by differential collective pitch change between the rear and forward rotors, and directional control by differential cyclic pitch of the two front rotors.

The fixed landing gear was designed by Automotive Products and consists of three wheels mounted on legs which have a travel of 5 ft. (1.52 m.).

For spraying purposes a stainless-steel tank of 500 Imp. gallons (2,273 litres) capacity is installed in the fuselage, and the chemical liquid is delivered at the rate of 100 Imp. gallons (455 litres) per minute at a pressure of 350 lbs./sq. in. (24.6 kg./sq. c/m.).

At the time of writing a full-size mock-up of the Air Horse had been completed and the prototype aircraft was being built.

ROTOR DIAMETER (Each).—46 ft. 0 in. (14.02 m.).

WEIGHT LOADED (Designed).—15,000 lbs. (6,802 kg.).

PERFORMANCE (Estimated).—Maximum speed 115 m.p.h. (185 km.h.), Cruising speed 88 m.p.h. (142 km.h.), Rate of vertical ascent 1,440 ft./min. (439 m./min.).

THE CIERVA W.9 HELICOPTER.

The W.9 is an experimental helicopter which uses a jet thrust for torque compensation instead of the conventional tail rotor. The main three-blade rotor is driven by a 200 h.p. D.H. Gipsy Six Series III six-cylinder in-line air-cooled engine mounted in the fuselage. A multi-blade fan with variable-pitch blades is

***CIERVA**—continued.*

The Cierva W.9 Experimental Helicopter (200 h.p. D.H. Gipsy-Six Series III engine).

used to cool the engine, and the air therefrom after leaving the engine bay is ducted along the fuselage and heated by mixture with the exhaust gases from the engine. It is then ejected from the port side of the fuselage at the extreme stern. Two horizontal shutters on the outlet control the flow, and the pitch of the fan blades is operated by the rudder-bar. At normal setting the jet thrust is just sufficient to balance the torque reaction.

The W.9 has a metal fuselage of tapered cylindrical form to which is attached at the forward end a steel-tube structure carrying the main rotor pylon, the two-wheel landing gear and the two-seat enclosed cabin. The main rotor blades are of wooden construction.

No further details of the W.9 were available for publication at the time of writing, but its general form may be gathered from the accompanying photograph.

CUNLIFFE-OWEN.

CUNLIFFE-OWEN AIRCRAFT, LTD.

HEAD OFFICE AND WORKS: SWAYTHLING, SOUTHAMPTON.

Directors: Sir Hugo Cunliffe-Owen, Bt. (Chairman), M. J. H. Bruce, C.B.E., B.Sc., M.I.Mech.E. (Managing Director), J. W. S. Comber and W. Gordon Hill.

Chief Designer: W. Garrow-Fisher, F.R.Ae.S.

Cunliffe-Owen Aircraft, Ltd. was formed in 1937. The company's first project was a "Flying Wing" aircraft based on the Burnelli Lifting-fuselage patents. This machine, known as the O.A. Mk. I, was completed in 1939. It was fitted with two 900 h.p. Bristol Perseus XIIC sleeve valve engines, and was acquired by the French Authorities for transport purposes in Africa during the War. A second "Flying Wing", known as the O.A. Mk. II, was designed but was never built. Descriptions of both these were given in the 1940 edition of this Annual.

During the War, Cunliffe-Owen Aircraft, Ltd. handled very extensive contracts and became an official "Sister Firm" for a number of American aircraft manufacturers. A Sister Firm's responsibilities covered the design work, manufacture and retrospective incorporation of many modifications which were found necessary to keep the aircraft concerned up to R.A.F. operational standard. The American companies with which Cunliffe-Owen was linked through the Ministry of Aircraft Production during the War included the Lockheed Aircraft Corporation, the Consolidated Vultee Aircraft Corporation and the Glenn L. Martin Company.

Since the war the Company has designed a 10/12-seat feeder-line aircraft known as the Concordia, the prototype of which was under construction at the time of writing. Two Concordias have been ordered by British European Airways Corpn., one for radio research and one for general development flying.

The Company is also engaged in prototype helicopter production for the Cierva Autogiro Co Ltd.

THE CUNLIFFE-OWEN CONCORDIA.

TYPE.—Ten/twelve-seat Feeder-line monoplane.

WINGS.—Cantilever low-wing monoplane. Single-spar structure in three main sections consisting of centre-section and two detachable outer wings. Detachable tips. Main spar at 30% chord has extruded light alloy T-section booms riveted to stiffened plate web, and is continuous through fuselage. Built-up false spar is pinned to fuselage bulkhead, and closes torsion-box formed by main spar and top and bottom skins. Braced channel-section ribs attached forward and aft of spar, and spanwise stringers. Stressed metal skin of varying thickness riveted on. Incidence 3 degrees, Dihedral (on median line) 6½ degrees, Root chord (on fuselage centre-line) 11 ft. 8.4 in. (3.57 m.), Tip chord (at outer end of aileron) 4 ft. 8.15 in. (1.42 m.), Centre-section span 20 ft. (6.1 m.). Aspect ratio 7.46. All-metal ailerons with trim-tab in each, and electrically-operated slotted trailing-edge flaps carried on false spar. Gross wing area 435 sq. ft. (40.5 sq. m.).

FUSELAGE.—All-metal monocoque structure. Built-up light alloy transverse frames, bulb-section extruded light alloy longitudinal stringers and stressed metal skin. Structural bulkheads between pilot's compartment and main cabin; at main and false-spar attachments and at tail pick-up points.

TAIL UNITS.—Cantilever monoplane type. All-metal structure with horn-balanced and aerodynamically-balanced rudder and elevators. Trim-tabs in each. Tailplane span 20 ft. (6.1 m.).

LANDING GEAR.—Retractable tricycle type. Main wheels carried on shock-absorber legs retract forward into engine nacelles between fire-proof bulkhead and main spar and are enclosed by doors. Full-castering self-centring nose-wheel attached to heavy keel members under fuselage retracts rearwards and turns through 90 degrees so as to lie flat within fuselage. Electric operation with emergency manual lowering gear. Track 15 ft. 6 in. (4.72 m.), wheel base 15 ft. (4.57 m.). Main wheel tyre pressure 40 lbs./sq. in. (2.8 kg./sq. c/m.), nose-wheel tyre pressure 45 lbs./sq. in. (3.16 kg./sq. c/m.).

POWER PLANT.—Two 500 h.p. Alvis Leonides nine-cylinder radial air-cooled engines enclosed in long-chord cowlings with leading-edge exhaust collector rings and controllable trailing-edge gills. Engine centres 15 ft. 6 in. (4.72 m.). De Havilland or Rotol three-blade constant-speed full-feathering and braking airscrews, 9 ft. (2.74 m.) diameter, with electro-hydraulic control. Airscrew ground clearance 12 in. (30.5 c/m.). Four flexible crash-proof fuel-tanks in wing leading-edge with total capacity of 200 Imp. gallons (910 litres).

ACCOMMODATION.—Crew compartment forward separated from main cabin by bulkhead. Main sound-proofed cabin has accommodation for up to twelve passengers, six on each side of central aisle. Entry door 4 ft. 4 in. × 2 ft. 3 in. (1.32 m. × 0.68 m.) on port side aft of wing. Windows have double layer of safety-glass with sealed anti-misting space between, and are built into removable break-out panels to act as emergency exits. Toilet and luggage compartments at rear. Over-seat racks in cabin for personal luggage. Total luggage capacity 45 cub. ft. (1.27 cub. m.).

DIMENSIONS.—Span 57 ft. (17.38 m.), Length 44 ft. 2 in. (13.45 m.), Height (overall) 16 ft. 8 in. (5.12 m.).

WEIGHTS AND LOADINGS (Designed).—Weight empty 7,031 lbs. (3,189 kg.), Disposable load 3,969 lbs. (1,800 kg.), Weight loaded 11,000 lbs. (4,989 kg.), Wing loading 25.3 lbs./sq. ft. (123.47 kg./sq. m.), Power loading (take-off power) 11 lbs./h.p. (4.98 kg./h.p.).

PERFORMANCE (Estimated).—Maximum speed 223 m.p.h. (359 km.h.) at 3,255 ft. (990 m.), Weak-mixture cruising speed (60% power) 190 m.p.h. (306 km.h.) at 7,000 ft. (2,135 m.), Stalling speed (flaps down) 70 m.p.h. (113 km.h.), Maximum rate of climb 1,420 ft./min. (433 m./min.), Maximum one-engine rate of climb 360 ft./min. (110 m./min.), Service ceiling 21,000 ft. (6,400 m.), Maximum range 1,200 miles (1,930 km.), Take-off run 316 yds. (290 m.).

DE HAVILLAND.

THE DE HAVILLAND AIRCRAFT CO., LTD.

Head Office, Works and Aerodrome : Hatfield, Herts.
Engine Works : Stonegrove and Stag Lane, Edgware, Middlesex.
Airscrew Works : Edgware, Middlesex, and Bolton, Lancashire.
Aeronautical Technical School : Hatfield.
Chairman : A. S. Butler.
Technical Director : Sir Geoffrey de Havilland, C.B.E., A.F.C., F.R.Ae.S.
Director and Chief Engineer : C. C. Walker, A.M.Inst.C.E., A.F.R.Ae.S.
Managing Director : W. E. Nixon.
Business Director : Francis E. N. St. Barbe.
Director and Chief Designer : R. E. Bishop, C.B.E.

Associated Companies :—
The de Havilland Aircraft Pty., Ltd., Kingsford Smith Aerodrome, Mascot, N.S.W., Australia.
The de Havilland Aircraft Co. of New Zealand, Ltd., Rongotai, Wellington, New Zealand.
The de Havilland Aircraft of Canada, Ltd., Station L, Toronto, Canada.
The de Havilland Aircraft Co., Ltd., Finlay House, McLeod Road, Karachi, India.
The de Havilland Aircraft Co. of S.A. (Pty.), Ltd., Johannesburg, S. Africa.
The de Havilland Aircraft Co. (Rhodesia) Ltd., Salisbury, S. Rhodesia.
The de Havilland Forge, Ltd., England.
The Hearle-Whitley Engineering Co., Ltd., England.
Airspeed, Ltd., Portsmouth, England.

The de Havilland Aircraft Co., Ltd., which was founded in 1920, had, up to 1939, concentrated mainly on the development of commercial aircraft of all types. Its pre-war history was largely a record of the production of successful civil aircraft which have given exceptional service all over the World and under the widest possible range of operating conditions.

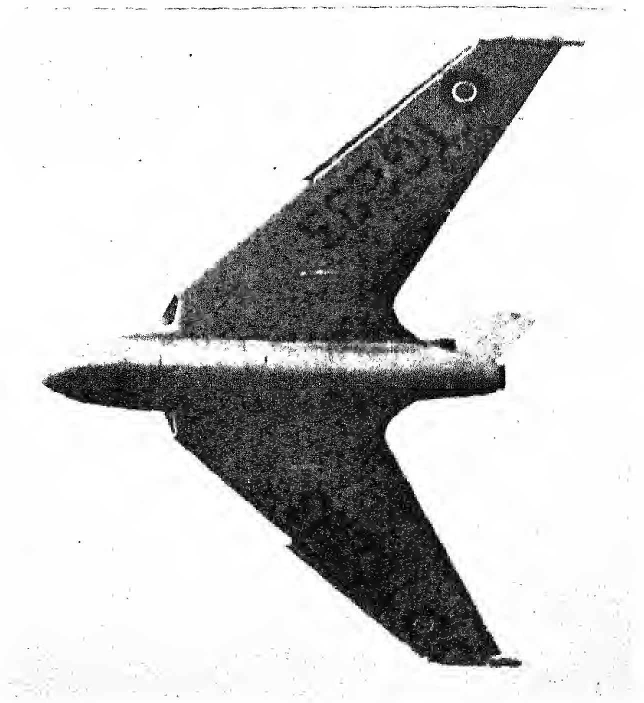
The de Havilland company's achievements in the military field during the War 1939-45 were equally noteworthy. The D.H. Mosquito was probably the most versatile aircraft produced by any country to go into operational service during the war. Developed during the war but too late to go into service, the Vampire single-seat jet-propelled fighter was the first aeroplane to exceed 500 m.p.h. (805 km.h.) in level flight, and the Hornet was at the time of its production the fastest airscrew-driven aeroplane in the World. The Vampire, fitted with deck-arrester gear, was the first jet-propelled fighter to land on and take off from the deck of an aircraft-carrier.

Since the war the company has returned to the civil field and its first post-war product, the D.H.104 Dove, achieved immediate success and is now in production for delivery to operators in all parts of the World. The Dove has also been ordered for service in the R.A.F. as a communications aircraft.

The D.H.108, the first successful tail-less jet-propelled aircraft, has been built to provide aerodynamic data for the D.H.106, a 75,000-lb. (34,050 kg.) gas-turbine airliner for service on the North Atlantic route. The final form of the D.H.106 will depend to a considerable extent upon the outcome of the research work done with the D.H.108.

Production at Hatfield is now concentrated on the Dove and the Hornet. The Vampire is in production at the Preston works of the English Electric Co., Ltd. for the R.A.F. and this aeroplane is also being built in Australia for the R.A.A.F. and under licence in Sweden for the Swedish Royal Air Force. Production of the Dragon Rapide has continued at the Brush Coachworks at Loughborough since the war, but this was being tapered off to cease finally by the end of 1946. The Mosquito still continues in production.

For details of the products and activities of the Australian and Canadian de Havilland companies see under "Australia" and "Canada" respectively.



The D.H. 108 Experimental Jet-propelled Tail-less Monoplane

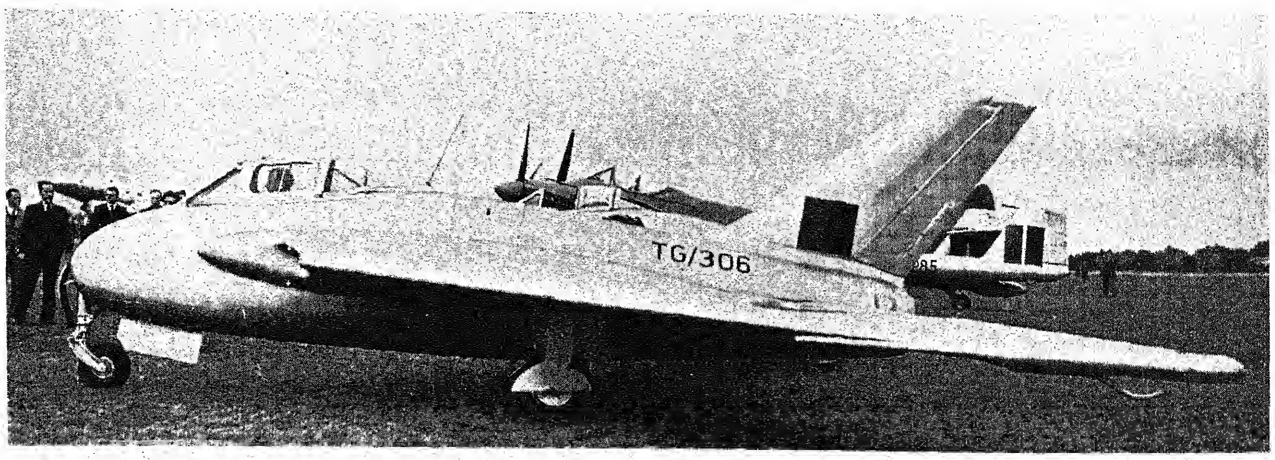
The Company introduced the manufacture and general use of variable-pitch airscrews into Great Britain in 1934-35. The range of D.H. airscrews in production covers piston-engine and turbine requirements from about 90 h.p. to 4,000 h.p. and larger airscrews up to 7,000 h.p. are in the advanced design stage. The latest developments are a six-blade contra-rotating constant-speed airscrew and a new Hydromatic airscrew incorporating both feathering and reversible pitch for braking.

Details of de Havilland aero-engines will be found in the appropriate section of this Annual.

THE D.H. 108.

The D.H.108 is an experimental jet-propelled tail-less monoplane which has been built solely for the purpose of investigating stability and control problems which arise in aircraft with swept-back wings, and to provide aerodynamic data for the projected D.H.106 (Brabazon IV) transocean transport aircraft. Initial work on the project began in October, 1945, and to get the aircraft completed quickly a standard Vampire fuselage, complete with D.H. Goblin gas turbine was used. This first prototype flew on May 15, 1946, from Woodbridge aerodrome, Suffolk.

The D.H. 108 is a mid-wing monoplane, the tapered wings of which are sharply swept-back on both leading and trailing-edges. The only other surface consists of a swept-back fin and rudder of high aspect ratio. The wings, fin and rudder are wooden structures. Lateral and longitudinal control is by "elevons" on the wings. Trailing-edge flaps and leading-edge slots are fitted, the slots in the first prototype being of the fixed open type whereas those on the second prototype are automatic and can be locked shut. Anti-spin parachutes are contained in streamlined fairings at the wing-tips. The landing gear is a retractable tricycle.



The D.H. 108 Experimental Tail-less Monoplane (D.H. Goblin turbo-jet engine).

DE HAVILLAND—*continued.*

THE D.H. 104 DOVE.

TYPE.—Twin-engined eight/eleven-passenger Light Transport.

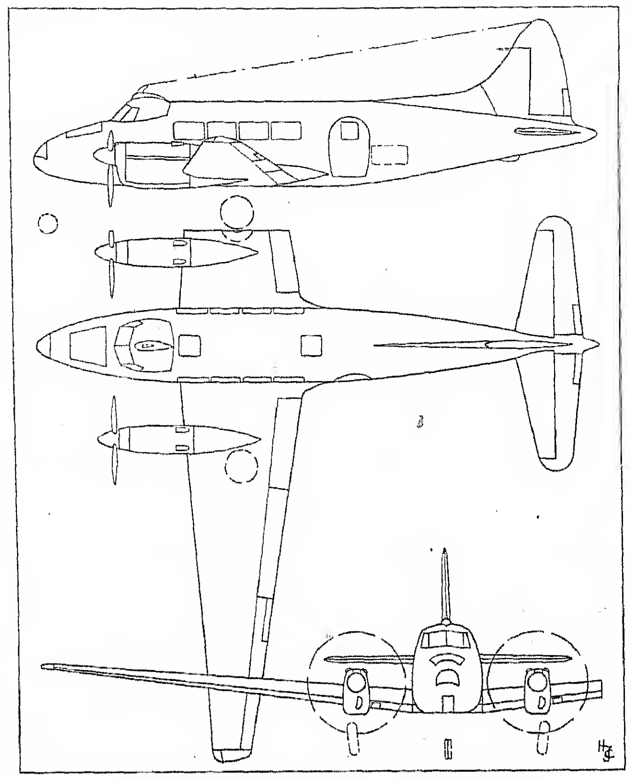
WINGS.—Cantilever low-wing monoplane. Piercy aerofoil section maximum thickness at 35% chord; 2½% (modified R.A.F. 34) camber line. All-metal structure in two main sections each attached by three high-tensile steel pins to built-up box-section centre-section spar integral with fuselage. Single I-section main spar with extruded booms and aluminium sheet webs. Built-up light alloy rear secondary spar carrying ailerons and flaps. Pressed aluminium-alloy sheet false spar (to which engine mountings attached) in front of main spar is set back between fuselage and rib outboard of nacelles and stepped forward outboard of nacelles. Pressed-aluminium-alloy sheet ribs, with strong ribs at roots, engine mounting pick-ups and outboard of wheel wells. Stressed aluminium-alloy Redux-bonded skin riveted to spars and ribs. Top and bottom skins project behind rear spar and form aileron and flap shrouds. Leading-edge inboard of nacelles and sections in outer wings hinge upwards for access to engine controls, etc. Detachable wing-tips. Root chord 8 ft. 8 in. (2.64 m.); tip chord 2 ft. 6½ in. (.77 m.); aspect ratio 9.7; incidence 2 degrees; dihedral (top front spar) 4 degrees. Gross wing area 335 sq. ft. (31.12 sq. m.). Mass-balanced aluminium-alloy ailerons with single spar, D-nose, tail ribs and fabric covering. Trim-tab in each, adjustable on ground only. Metal aileron area 10.9 sq. ft. (1 sq. m.); movement 20 degrees up and down. Tab area 0.87 sq. ft. (.08 sq. m.). Pneumatically-operated plain-hinge flaps, constructed as ailerons, in two sections each side. Total flap area 19.8 sq. ft. (1.84 sq. m.) Two extended flap positions: 20 degrees (take-off) and 60 degrees (landing).

FUSELAGE.—Oval-section monocoque structure of three main longerons each side, vertical frames, V-section longitudinal stringers and Redux-bonded stressed aluminium-alloy skin. Constructed in three main units, nose, cabin and rear fuselage, riveted together. Nose-section made up of two side panels; lower unit comprising nose-wheel well and floor, and upper deck and canopy. Cabin section similarly constructed with two sides and top and bottom panels. Cabin floor of two plasticised panels sandwiched between thin light alloy sheets supported on transverse light-alloy members. Rear fuselage made in two halves joined on top and bottom centre-lines, and has three main lateral bulkheads.

TAIL UNIT.—Cantilever monoplane type. Fin and tailplane have pressed light alloy spars and ribs and stressed light alloy skin riveted on. Tailplane adjustable for incidence on ground. Skins project beyond rear spar to form shrouds for control surfaces. Rudder and elevators of similar construction with single spar, shaped leading-edge, nose and tail ribs and fabric covering. Elevators interchangeable left and right. Rudder and elevator mass balances contained in horn-balanced portions. Controllable metal trim-tabs in rudder and elevators. Fin area 20.4 sq. ft. (1.89 sq. m.), Rudder area 13.75 sq. ft. (1.27 sq. m.), Rudder movement 25 degrees each way, Rudder tab area 0.93 sq. ft. (.086 sq. m.). Tab movement 18 degrees each way, Tailplane area 35.46 sq. ft. (3.28 sq. m.), Elevator area (total) 24.5 sq. ft. (2.27 sq. m.), Elevator movement 25 degrees up, 15 degrees down, Elevator tab area (total) 2.14 sq. ft. (.19 sq. m.), Tab movement 13 degrees up, 20 degrees down.

LANDING GEAR.—Retractable tricycle type, main wheels retracting outwards into wings and nose-wheel backwards into fuselage. Each main wheel carried on outside of single rubber-compression shock-absorber leg hinged to heavy rib between spars aft of nacelle. Legs complete with radius-rod attachments interchangeable left and right. Dunlop wheels, tyres and brakes. Nose-wheel carried in levered fork on Lockheed air-oil shock-absorber strut which retracts backwards into fuselage. Spring-loaded self-centering device. Dunlop wheel with Marstrand two-track tyre. Pneumatic retraction at pressure of 450 lbs./sq. in. (31.6 kg./sq. c/m.) with mechanical emergency lowering gear. Retraction 4.5 seconds, lowering 3.5 seconds. Track 13 ft. 9 in. (4.19 m.), Wheel base 13 ft. 0 in. (3.96 m.).

POWER PLANT.—Two de Havilland Gipsy Queen 70 geared and supercharged six-cylinder in-line inverted air-cooled engines on welded steel-tube mountings with rubber-bonded vibration dampers. Maximum level output 305 b.h.p. at 6,200 ft. (1,890 m.) and with 330 b.h.p. available for take-off. Engines complete with all accessories form self-contained power-eggs which are quickly detachable and interchangeable right and left. Spot-welded cowlings with hinged sides. D.H. Hydromatic 3/100/2 three-blade constant-speed feathering and braking airscrews, 7 ft. 5 in. (2.26 m.) diameter. Constant-speed range 25 degrees; total pitch range 120 degrees. Total fuel capacity 130 Imp. gallons (591 litres). One 26 Imp. gallon (118 litres) tank in each wing root forward of spar and one of 39 Imp. gallons (177 litres) capacity aft of spar. Oil capacity 10 Imp. gallons (45.5 litres).

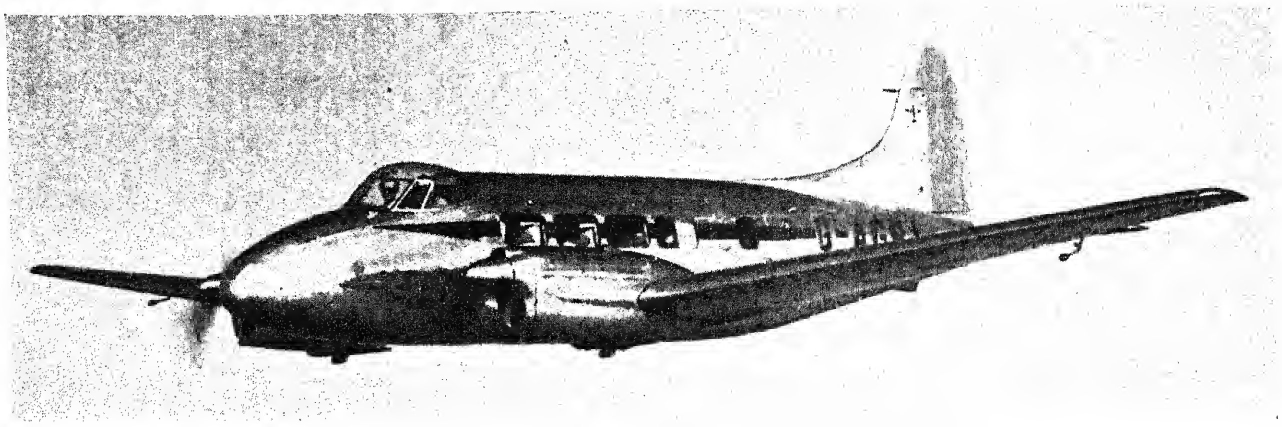


The D.H. Dove Light Twin-engined Transport.

ACCOMMODATION.—Enclosed cockpit seating pilot and co-pilot/radio-operator side-by-side with dual controls. Entry to cockpit in bulkhead at front of main cabin. Main cabin, ventilated and sound-proofed with glass wool, has accommodation for eight passengers in four seats on each side of central aisle. Four large windows each side. Dunlopillo-padded seats. Main entry door, 2 ft. 3 in. (0.68 m.) from ground on port side aft of rear cabin bulkhead, with another door into cabin. Elsan toilet on starboard side of vestibule opposite main entry door and concealed by cabin door when open. Rear cabin bulkhead and lavatory can be removed to provide a ninth passenger seat. In eleven-passenger version bulkhead aft of vestibule removed and two further seats installed. Main cabin 11 ft. 9 in. long × 5 ft. 2½ in. wide × 4 ft.

The D.H. Dove Light Transport (two D.H. Gipsy Queen 70 engines).

***DE HAVILLAND**—continued.*



The D.H. Dove Light Transport (two D.H. Gipsy Queen 70 engines).

6 in. high (3.58 m. × 1.58 m. × 1.37 m.). Volume 246 cub. ft. (6.96 cub. m.). Two emergency exits in roof. Forward luggage compartment under floor of cockpit with volume of 22 cub. ft. (0.62 cub. m.). Maximum load 300 lbs. (136 kg.). Maximum permissible floor loading 100 lbs./sq. ft. (488 kg./sq. m.). Hatch 2 ft. 3 in. × 1 ft. 5½ in. (0.68 × 0.44 m.) on port. Aft luggage compartment (on eight-nine seat aircraft) with volume of 45 cub. ft. (1.27 cub. m.). Maximum load 600 lbs. (272 kg.), Maximum permissible floor loading 150 lbs./sq. ft. (732 kg./sq. m.). Hatch 2 ft. 5 in. × 2 ft. 1½ in. (0.73 × 0.64 m.) on starboard. On eleven-seat aircraft 22 cub. ft. (0.62 cub. m.) luggage space available aft of rear seats.

Dimensions.—Span 57 ft. 0 in. (17.37 m.), Length 39 ft. 4 in. (11.98 m.), Height (over rudder) 13 ft. 0 in. (3.96 m.), Height (over cockpit canopy) 8 ft. 10 in. (2.69 m.).

Weights and Loadings (Eight-passenger version).—Weight empty (equipped) 5,625 lbs. (2,551 kg.). Payload 1,868 lbs. (847 kg.), (1,898 lbs.=861 kg. and 1,893 lbs.= 859 kg. on nine-seat and eleven-seat aircraft respectively). Weight loaded 8,500 lbs. (3,855 kg.), Wing loading (fully loaded 25.36 lbs./sq. ft. (123.76 kg./sq. m.). Power loading (at take-off) 12.89 lbs./h.p. (5.84 kg./h.p.).

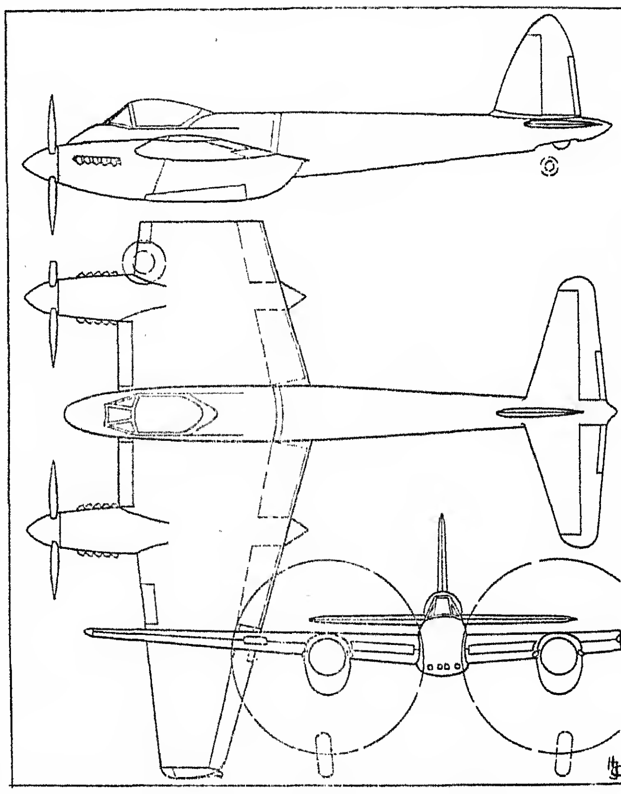
Performance (At 8,500 lbs.=3,855 kg. and with standard equipment).—Maximum level speed 222 m.p.h. (357 km.h.) at 5,800 ft. (1,770 m.), Maximum weak mixture cruising speed 200 m.p.h. (322 km.h.) at 8,500 ft. (2,590 m.), Cruising speed at 50% take-off power 155 m.p.h. (249 km.h.) at 5,000 ft. (1,525 m.). Rate of climb at sea level 750 ft./min. (229 m./min.), Rate of climb at sea level on one engine 230 ft./min. (70 m./min.), Climb to 5,000 ft. (1,525 m.) 6.5 minutes, to 10,000 ft. (3,050 m.) 12.9 minutes. Service ceiling 18,500 ft. (5,640 m.), Range, with 1,700 lbs. (771 kg.) payload, 500 miles (805 km.), Take-off distance to 50 ft. (15 m.) 770 yds. (704 m.), Landing distance from 50 ft. (15 m.) 750 yds. (686 m.), Fuel consumption (at cruising speed) 22 Imp. gallons per hour (100 litres per hour) (7.05 m.p.g.=2.52 km. per litre), Consumption at maximum weak mixture cruising speed 34 Imp. gallons per hour (155 litres per hour) (5.9 m.p.g.=2.10 km. per litre).

THE D.H. 103 HORNET.

The D.H. 103 twin-engined fighter was designed to Specification F.12/43 and the first prototype flew on July 28, 1944, less than 13 months from the time the design was initiated. The Hornet went into production at Hatfield at the end of 1944 and deliveries to the R.A.F. began in February, 1945.

The following are the principal versions of the Hornet to which reference may be made:—

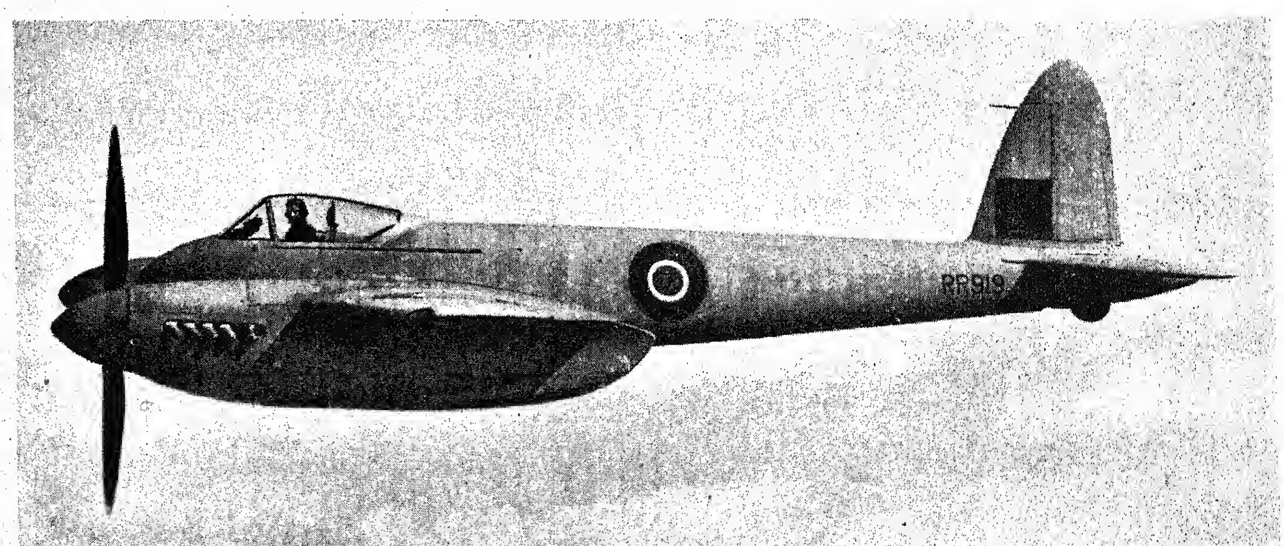
Hornet F. Mk. I. Single-seat fighter with armament of four 20 m/m. cannon and with provision for carrying two 1,000-lb. (454 kg.) bombs or two 100 or 200 Imp. gallon (455 or 910 litres) drop tanks under wings.



The D.H. Hornet Twin-engined Fighter.

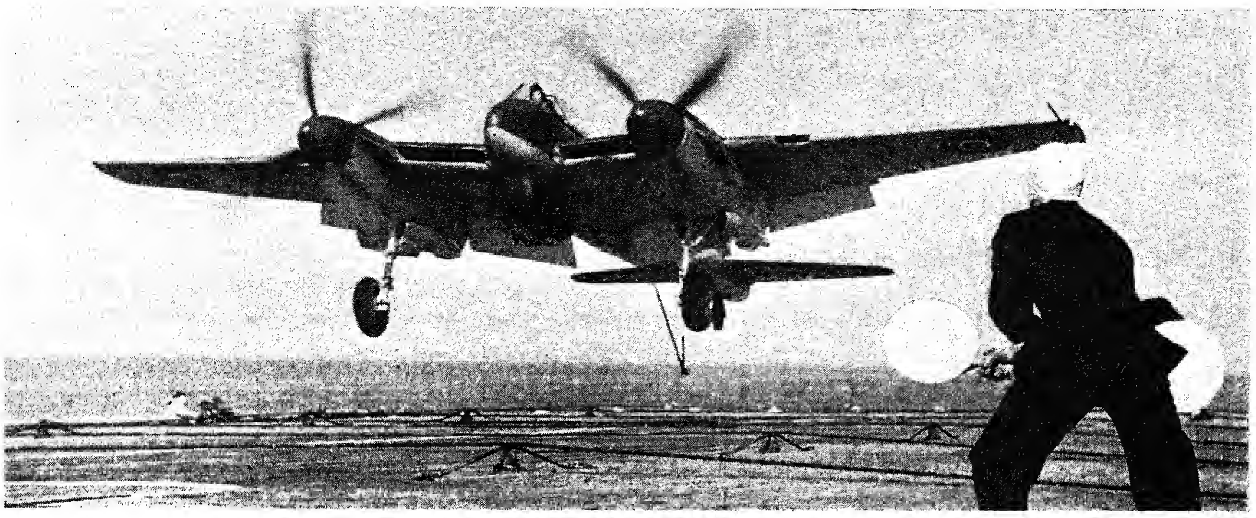
Hornet P.R. Mk. II. Unarmed photographic-reconnaissance version of the F. Mk. I, with comprehensive camera equipment.

Hornet F. Mk. III. Long-range version of Mk. I with re-designed wings to accommodate extended fuel system. Also fitted with new bomb-gear and R.P. racks.



The D.H. Hornet Single-seat Fighter (two Rolls-Royce Merlin 130/131 engines.)

DE HAVILLAND—*continued.*



The prototype Sea Hornet XX landing on H.M.S. Ocean during its deck-landing trials.

Sea Hornet F. Mk. XX. Shipboard version of F. Mk. I with folding wings, arrester hook, tail-down landing hooks and specialised naval radio and radar equipment. (See Sea Hornet).

TYPE.—Twin-engined single-seat fighter and Photographic Reconnaissance Monoplane.

WINGS.—Cantilever mid-wing monoplane. Aerofoil section E.C. 1240 series. Composite Redux-bonded two-spar structure built in one piece and attached to fuselage by six main bolts. Spars have compressed plywood webs, extruded light alloy bottom booms and spruce top booms. Ribs of composite compressed plywood and sheet alloy. Double top skin of stressed plywood reinforced by wooden spanwise stringers; Alclad bottom skin reinforced by extruded duralumin stringers extending from outer engine ribs to tips. All-metal leading-edge. Root chord (1 ft. 9 in.=0.53 m. from fuselage centre-line) 12 ft. 2 in. (3.7 m.), Tip chord (21 ft. 0 in.=6.4 m. from fuselage centre-line) 4 ft. 2 in. (1.27 m.). Incidence 1½ degrees, dihedral (on top front spar) 1 degree 11 minutes. Sweepback at rib No. 4, 6¼ degrees. Gross wing area 361 sq. ft. (33.53 sq. m.). Metal ailerons with metal covering. Aileron area (total) 17.5 sq. ft. (1.62 sq. m.), aileron movement 15 degrees up, 15 degrees down. Spring balance tab in starboard aileron, area 0.27 sq. ft. (0.025 sq. m.), tab movement 15 degrees up, 15 degrees down. Hydraulically-operated split trailing-edge flaps between ailerons and fuselage divided by nacelles. Flap area (total) 46 sq. ft. (4.27 sq. m.), flap depression 75 degrees.

FUSELAGE.—All-wood monocoque structure of oval tapering cross-section. Built in two halves and joined along top and bottom centre-lines. False longerons over widely-spaced bulkheads. Covering of sheet plywood laid on in diagonal panels, with balsa sandwich between. Length 30 ft. 0 in. (9.14 m.), Maximum width 3 ft. 2 in. (0.96 m.), Maximum depth (less canopy) 4 ft. 1.92 in. (1.27 m.).

TAIL UNIT.—All-metal cantilever structure with metal covering. Two-spar tailplane. Fin integral with fuselage. Statically-balanced rudder and statically and horn-balanced elevators of all-metal construction with metal skin and spring balance tabs. Tailplane span 18 ft. 1.4 in. (5.5 m.), Root chord, with elevator, 5 ft. 1½ in. (1.55 m.), Incidence nil, Tailplane area (net) 32.85 sq. ft. (3.05 sq. m.), elevator area (total) 22.15 sq. ft. (2.05 sq. m.), Elevator movement 20 degrees up, 15 degrees down, Elevator tab area (each) 1.08 sq. ft. (0.1 sq. m.), Tab movement 15 degrees up, 15 degrees down. Fin area 10.3 sq. ft. (0.95 sq. m.), Rudder area (with tab) 12.1 sq. ft. (1.12 sq. m.), Rudder movement, 30 degrees each way, Rudder tab area 1.39 sq. ft. (0.129 sq. m.), Movement 30 degrees each way.

LANDING GEAR.—Retractable two-wheel type. Each main Dunlop wheel carried on rubber-in-compression shock-absorber leg. Backwards retraction, hydraulic operation. Emergency hand-pump and air system. Dunlop brakes. Track 14 ft. 6 ft. (4.42 m.). Backwards-retracting tail-wheel with Dunlop-Marstrand multi-tread tyre has rubber-in-compression springing with Ferodo friction-disc dampers.

POWER PLANT.—Two Rolls-Royce Merlin 130 series (130 port, R.H. rotation and 131 starboard, L.H. rotation) twelve-cylinder Vee liquid-cooled engines, maximum output (F.S., combat power) 2,030 h.p. at 3,000 r.p.m. at 1,250 ft. (380 m.). Engines mounted on steel-tube bearers attached to front spar. D.H. Hydromatic 4/4000/5 four-blade narrow-chord full-feathering and reversing airscrews. 12 ft. 0 in. (3.66 m.) diameter. Normal fuel capacity 432 Imp. gallons (1,963 litres) in five main self-sealing tanks, top fuselage tank (long-range only) (60 Imp. gallons=273 litres), bottom centre tank (48 Imp. gallons=218 litres), wing tanks port and starboard, two of 85 Imp. gallons (386 litres) and two of 77 Imp. gallons (350 litres). Total fuel capacity with two 100 Imp. gallons (455 litres) drop-tanks, 632 Imp. gallons (2,873 litres), with two 200 Imp. gallon (910 litres) drop-tanks, 832 Imp. gallons (3,783 litres). Oil-tank capacity 15½ Imp. gallons (70 litres) including 3 Imp. gallons (13.6 litres) air-space. Radiator air-intakes in leading-edge of extended centre-section. Air intakes in leading-edge outboard of nacelles.

ACCOMMODATION.—Pilot's cockpit mounted well forward with front and side windscreens of bullet-proof laminated glass. Canopy of moulded Perspex slides for access and can be jettisoned. Front cockpit bulkhead of armour-plate with head and back armour behind pilot.

ARMAMENT.—Four forward-firing 20 m/m. British Hispano cannon mounted in underside of nose. Racks for two 1,000 lb. (454 kg.) bombs and rocket projectiles under wings.

EQUIPMENT.—24-volt electrical system, with generator driven by port engine. T.R. 1464 and R.3121 radio. Camera-gun in nose.

DIMENSIONS.—Span 45 ft. 0 in. (13.71 m.), Length (tail up) 37 ft. 0 in. (11.27 m.), Length (tail down) 36 ft. 8 in. (11.17 m.), Height (tail up) 16 ft. 2 in. (4.92 m.), Height (tail down) 14 ft. 2 in. (4.26 m.), Height to wing tip 7 ft. 8 in. (2.33 m.).

WEIGHTS AND LOADINGS.—Weight loaded (short-range fighter) 16,100 lbs. (7,303 kg.), (long-range fighter) 20,900 lbs. (9,480 kg.), (short range P.R.) 15,900 lbs. (7,212 kg.), (long range P.R.) 20,000 lbs. (9,163 kg.), Wing loading 44.5 lbs./sq. ft. (217 kg./sq. m.), Power loading 4.85 lbs./h.p. (3 kg./h.p.), Span loading 8 lbs./sq.ft. (39 kg./sq. m.).

PERFORMANCE.—Maximum speed (F.S. gear) with no external equipment 472 m.p.h. (760 km.h.) at 22,000 ft. (6,710 m.), Maximum speed (M.S. gear) 438 m.p.h. (705 km.h.) at 10,000 ft. (3,050 m.), Rate of climb (combat) 4,000 ft./min. (1,220 m./min) up to 15,000 ft. (4,575 m.), Operational ceiling 35,000 ft. (10,670 m.), Maximum range (maximum fuel) 3,000 miles (4,830 km.) between sea-level and 20,000 ft. (6,095 m.).

THE D.H. 103 SEA HORNET XX.

The Sea Hornet is a naval adaptation of the R.A.F. Hornet previously described. It is fitted with folding wings, and has provision for deck-arrester and J.A.T.O. gear. Airdraulic shock-absorber legs have replaced the rubber-in-compression legs of the standard Hornet to eliminate bounce in carrier landings. Detail design of the naval modifications was entrusted to the Heston Aircraft Co. Ltd., but production is being handled by the de Havilland company.

The prototype Hornet fitted with arrester hook made its first deck-landing trials on H.M.S. *Ocean* on August 10, 1945.

The wings fold from a point just outboard of the engine nacelles and are hinged on the upper surface. Withdrawing and locking pins are located on the bottom flanges of the two spars. Lockheed hydraulic operation is employed.

The arrester gear consists of a V-shaped steel-tube frame terminating in a forged steel hook, and is held under the fuselage by a snap-gear. The arresting stresses are transferred to two spruce longerons specially incorporated in the fuselage. American three-point accelerator gear is fitted.

DIMENSIONS.—As Hornet.

WEIGHTS AND LOADINGS.—Weight loaded 18,250 lbs. (8,285 kg.), Wing loading 44.5 lbs./sq. ft. (217.2 kg./sq. m.), Power loading 4.85 lbs./h.p. (2.22 kg./c.v.), Span loading 8 lbs./sq. ft. (39.06 kg./sq. m.).

PERFORMANCE.—Maximum speed (M.S. gear) 438 m.p.h. (705 km.h.) at 10,000 ft. (3,050 m.), Maximum speed (F.S. gear) 472 m.p.h. (760 km.h.) at 22,000 ft. (6,705 m.) at 3,000 r.p.m. 20 lbs./sq. in. (1.4 kg./sq. c/m.) boost and no external equipment, Combat rate of climb 4,000 ft./min. (1,220 m./min.) to 15,000 ft. (4,570 m.), Operational ceiling 35,000 ft. (10,670 m.). Range 3,000 miles (4,828 km.) between sea-level and 20,000 ft. (6,095 m.) with maximum internal fuel tankage and two 200 Imp. gallon (910 litre) drop-tanks.

THE D.H. 100 VAMPIRE.

Design work on the D.H.100 was begun in May, 1942. and sixteen months later, on September 20, 1943, the first D.H. jet-propelled aircraft fitted with the first D.H. jet engine flew. The prototype Vampire exceeded 500 m.p.h. (805 km.h.) in the Spring of 1944 and was the first aeroplane in Britain or America to do so by a handsome margin and over a wide altitude range.

Because the de Havilland factories were fully occupied with other production, manufacture of the Vampire was entrusted to the English Electric Co. Ltd. at Preston, and production began there in April, 1944. The first production Vampire was assembled and flown at Preston in April, 1945. Modifications incorporated in the production Vampire included the substitution of the Goblin II engine for the Goblin I, the introduction

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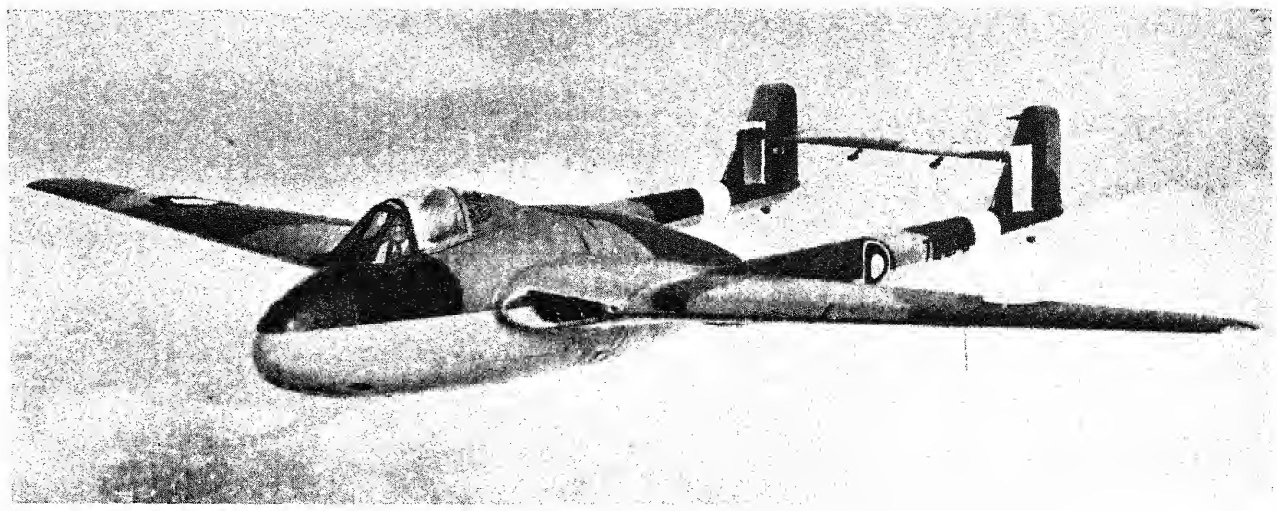


The D.H. Vampire Single-seat Jet-propelled Fighter (D.H. Goblin turbo-jet engine).

of cockpit pressurisation, increase of internal fuel tankage with additional tanks in the wings, and provision for external drop tanks.

In addition to being in R.A.F. service, the Vampire has been adopted as a standard fighter type by the Swedish Royal Air Force and manufacture of both the airframe and engine will be undertaken in Sweden. The Vampire is also being built in Australia for the Royal Australian Air Force. The Swiss Air Force has acquired four Vampires for service trials.

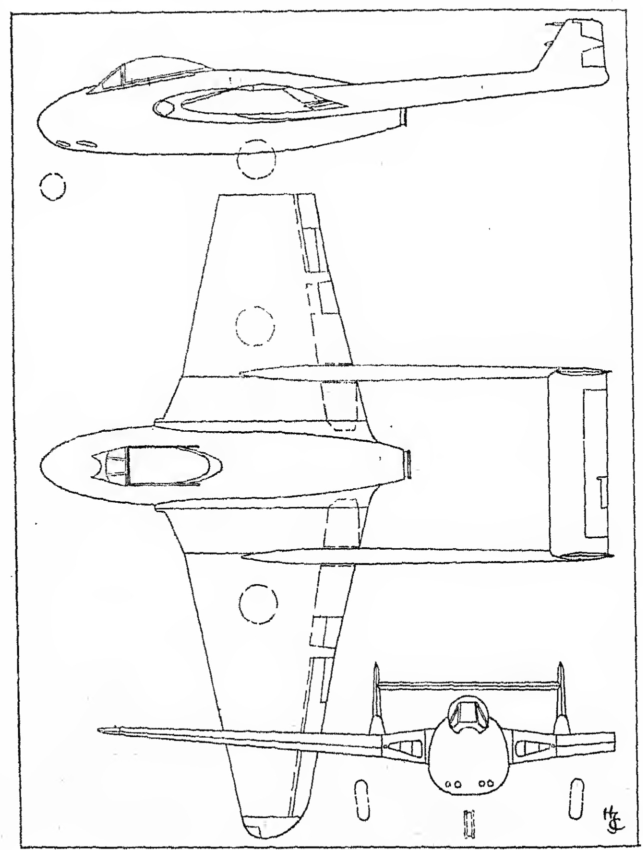
TYPE.—Single-seat jet-propelled twin-boom Fighter.

WINGS.—Cantilever mid-wing monoplane. Aerofoil section of E.C. 1240 series. Aspect ratio 6.2. Wing built in two sections each of which is attached directly to nacelle at three points. Section increased at roots to accommodate air intakes. Single I-section spar, former ribs and longitudinal stringers with flush-riveted 18 s.w.g. Alclad skin. Short false spar at wing leading-edge and second false spar to which flaps are hinged. Wing root chord (at 4.68 ft.=1.4 m. from fuselage centre-line) 8 ft. 6.17 in. (2.86 m.). Chord (at 18 ft. =5.48 m. from centre-line) 3 ft. 6.79 in. (1.07 m.). Incidence, nil. Dihedral (on top main spar) 1¼ degrees. Sweepback. 11 degrees 19 mins., Gross wing area 250.7 sq. ft. (23.29 sq. m.), All-metal mass-balanced ailerons with metal covering. Inset trim-tabs adjustable on ground only. Aileron area (each) 7.7 sq. ft. (.71 sq. m), Aileron movement 15 degrees 36 minutes up, 10½ degrees down. Tab area 0.746 sq. ft. (0.0693 sq. m.), Tab movement 5° 30′ up, 8° 30′ down. Hydraulically-operated all-metal split flaps on either side of tail-booms, used in conjunction with air-brake between ailerons and flaps. Flap area (total) 20.8 sq. ft. (1·93 sq. m.), Flap depression 80 degrees. Air-brakes move backward and rotate so as to present flat surface to slipstream disposed equally above and below wing. Air-brake area (each) 2.96 sq. ft. (.27 sq. in.).

NACELLE.—Composite structure. Main nacelle member is heavy transverse aluminium-alloy bulkhead of circular section in line with main wing-spar, which carries forward portion of nacelle in front and jet unit behind. Nose-piece as far as wing leading-edge is monocoque structure with plywood and balsa sandwich skin. Length 19 ft. 2 in. (5.84 m.), Maximum width 4 ft. 6 in. (1.37 m.), Maximum depth 4 ft. 6 in. (1.37 m.).

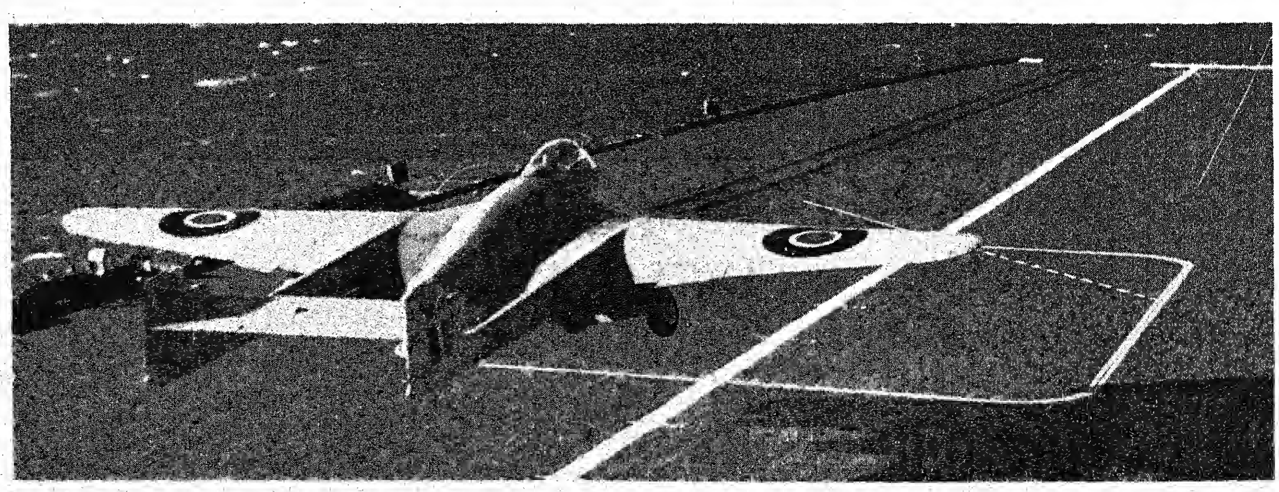
TAIL BOOMS.—All-metal structures of elliptical section composed of vertical frames and longitudinal stringers with Alclad covering, thick on top and bottom and thin on sides. Stub booms built on to heavy wing rib and project from top surface aft of main spar, ending in aluminium-alloy castings to which booms are attached.

TAIL UNIT.—All-metal cantilever structure. Twin fins and rudders mounted above tail booms with constant-chord tailplane and single elevator between. Rudders each in two portions on common



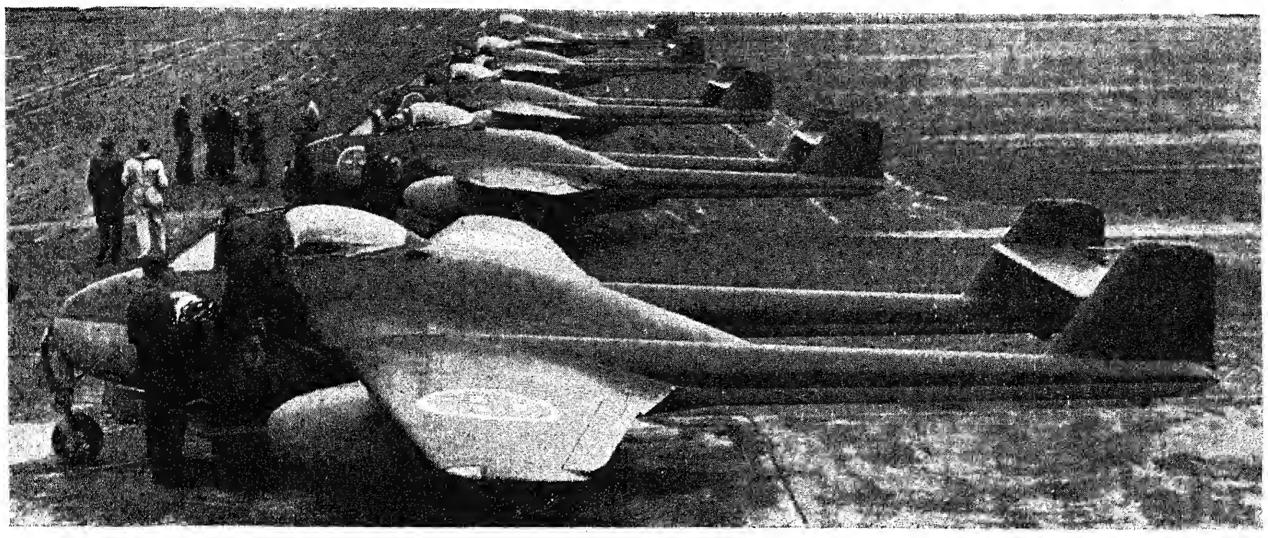
The D.H. 100 Vampire.

hinge. Internally mass-balanced rudders and externally mass-balanced elevator. Controllable trim-tab in elevator. Rudder



The D.H. Sea Vampire Single-seat Fleet Fighter (D.H. Goblin turbo-jet unit).

DE HAVILLAND—*continued.*



D.H. Vampire Single-seat Jet-propelled Fighters ready for delivery to the Swedish Air Force.

tabs adjustable on ground only. Stressed metal skin over fixed and movable surfaces. Tailplane span (over booms) 10 ft. 6 in. (3.2 m.), Chord 3 ft. 7 in. (1.09 m.), area 21 sq. ft. (1.95 sq. m.). Elevator area (with tab) 12.9 sq. ft. (1.19 sq. m.), Elevator movement 19 degrees 2 minutes up, 12 degrees 48 minutes down. Tab area 0.565 sq. ft. (0.052 sq. m.), trim 12 degrees up and down. Fin area (each) 5.58 sq. ft. (.517 sq. m.), Rudder area (each, with tab) 3.68 sq. ft. (.34 sq. m.), Rudder movement 25 degrees each way, Tab area 0.058 sq. ft. (0.0053 sq. m).

LANDING GEAR.—Retractable tricycle type. Each main wheel carried on single oleo-pneumatic shock-absorber leg attached behind main spar to heavy rib. Wheels retract outwards into wing and are fully-enclosed by fairing plates attached to legs and underside of wing. Hydraulic operation. Pneumatic braking system. Nose-wheel, carried in fork on shock-absorber leg hinged to extreme nose, retracts backwards into fuselage and is fully enclosed. Two-tread nose-wheel tyre. Faired emergency bumper skid under rear of each boom. Track 11 ft. 3 in. (3.43 m.), Wheel base 11 ft. 3 in. (3.43 m.).

POWER PLANT.—One de Havilland Goblin II centrifugal-flow turbo-jet unit rated at 3,000 lbs (1,360 kg.) at 10,200 r.p.m. Engine mounted on welded steel-tube triangulated structure attached to rear of main nacelle bulkhead and converging on four main pick-up points. Air ducts, accessories, controls and fuel leads, etc. in space between bulkhead and engine. Engine covered by quickly-detachable metal panels. Air intakes in wing leading-edge each side of nacelle, and circular jet outlet in extreme rear of nacelle. Main fuel tank of 96 Imp. gallons (436 litres) in nacelle ahead of bulkhead and behind pilot. Two 53 Imp. gallon (241 litre) tanks in wing one on each side of nacelle. Two 100 Imp. gallon (455 litre) drop-tanks carried under wing, either outboard of under-carriage or at wing tips. Oil capacity 1½ Imp. gallons (6.8 litres) contained within engine.

ACCOMMODATION.—Pilot's pressurized cockpit ahead of wing leading-edge. Bullet-proof windscreen and sliding blister-type canopy. Both screen and canopy of double-skinned Perspex with silica-gell drying cells between. Marshall cabin blower. Maximum cabin pressure 2¾ lbs./sq. in. (.193 kg./sq. c/m.). Blower intakes in wing leading-edge outside jet intakes. Cabin intake in nose. Armour plating in front of and behind pilot.

ARMAMENT.—Four 20 m/m. British Hispano cannon in nacelle below floor of cockpit firing through apertures two on each side of nose-wheel. Magazines (600 rounds) in fuselage behind pilot.

EQUIPMENT.—24-volt electrical system. I.F.F. radio, two radio units, ciné-camera, de-icing, oxygen, etc.

DIMENSIONS.—Span 40 ft. 0 in. (12.19 m.), Length (overall) 30 ft. 9 in. (9.37 m.), Height (over rudders) 8 ft. 10 in. (2.64 m.), Height (to wing tip) 4 ft. 8 in. (1.42 m.).

WEIGHTS AND LOADINGS.—Weight empty 6,377 lbs. (2,893 kg.), Combat weight 8,578 lbs. (3,891 kg.), Weight loaded (with full drop-tanks) 10,298 lbs. (4,671 kg.), Wing loading (at combat weight) 34 lbs./sq. ft. (166 kg./sq. m.), Wing loading (without fuel or ammunition) 26.3 lbs./sq. ft. (108 kg./sq. m.).

PERFORMANCE.—Maximum continuous level speed 540 m.p.h. (869 km.h.), Still-air range at 400 m.p.h. (644 km.h.) at sea level 500 miles (805 km.), at 450 m.p.h. (724 km.h.) at 30,000 ft. (9,144 m.) 1,050 miles (1,690 km.), Take-off to 50 ft. (15 m.), fully loaded, 850 yds. (777 m.), Landing distance from 50 ft. (15 m.), at combat weight, 1,150 yds. (1,052 m.), Duration (with allowance for climb and 15 min. combat) at sea level at 270 m.p.h. (434 km.h.) 1.8 hrs., at 30,000 ft. (9,145 m.) at 400 m.p.h. (644 km.h.) 2.25 hrs.

THE D.H. 100 SEA VAMPIRE.

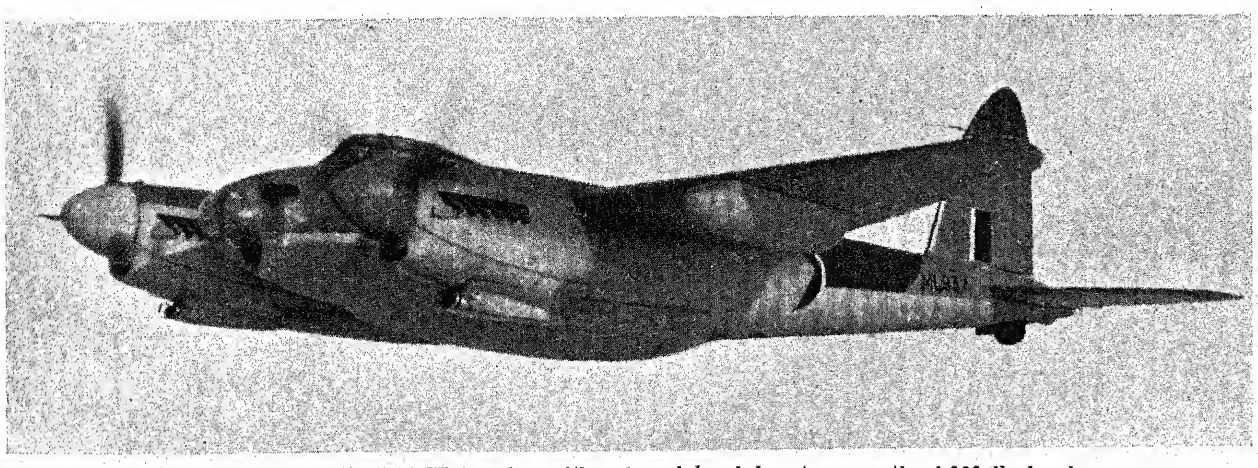
The Sea Vampire is a naval version of the standard R.A.F. F. Mk. I Vampire, from which it differs only in regard to equipment fitted. The deck arrester hook is hinged to the trailing-edge of the centre-section and when stowed is shielded by a fairing on the engine nacelle above the jet orifice.

The Vampire was the first jet-propelled aeroplane to land on and take-off from the deck of an aircraft-carrier. Its deck landing trials in the Light Fleet Carrier *Ocean* were completed in December, 1945.

THE D.H.98 MOSQUITO.

The Mosquito prototype unarmed bomber first flew on November 25, 1940, eleven months from the start of the design work. The makers' basic trials were completed in three months and the aircraft was handed over for R.A.F. trials on February 19, 1941. Meanwhile a fighter version was also being developed and the growing importance of long-range photographic reconnaissance also called for an adapted form of the bomber version. The fighter prototype was first flown on May 15, 1941, and the photographic reconnaissance prototype followed on June 10, 1941.

In July, 1941, the first three Mosquitos were delivered to the R.A.F. and in that month a production scheme which included manufacture by the Canadian de Havilland plant



The D.H. Mosquito B. XVI Bomber with enlarged bomb-bay to carry the 4,000 lb. bomb.

DE HAVILLAND—*continued.*

was planned. Plans to manufacture the Mosquito in Australia were negotiated nine months later.

From 1941 until August 15, 1945, 6,711 Mosquitos were built in Great Britain, Canada and Australia, and production has continued in both Great Britain and Australia. In Great Britain 4,363 were built by de Havilland, 917 by Standard Motors, 198 by Percival Aircraft and 12 by Airspeed, Ltd. Canada built 1,032 and Australia 108.

Details of Mosquito Mks. I-42 (including the Canadian and Australian-built versions) were given in the last issue of "All the World's Aircraft." The current production models are the Mks. III, 33, 34, 35 and 36 in Great Britain and the Mks. 41 and 43 in Australia. Many other versions remain in service in the Royal Air Force, the Air Forces of the Empire and certain of the Allied Air Forces.

Brief particulars of the versions still in production are given below.

Mosquito T. Mk. III. Two-seat Trainer modified from the Mk. II Fighter. Armament removed and dual-control fitted. Length 40 ft. 9½ ins. (12.43 m.).

Mosquito Mk. 33. See Sea-Mosquito.

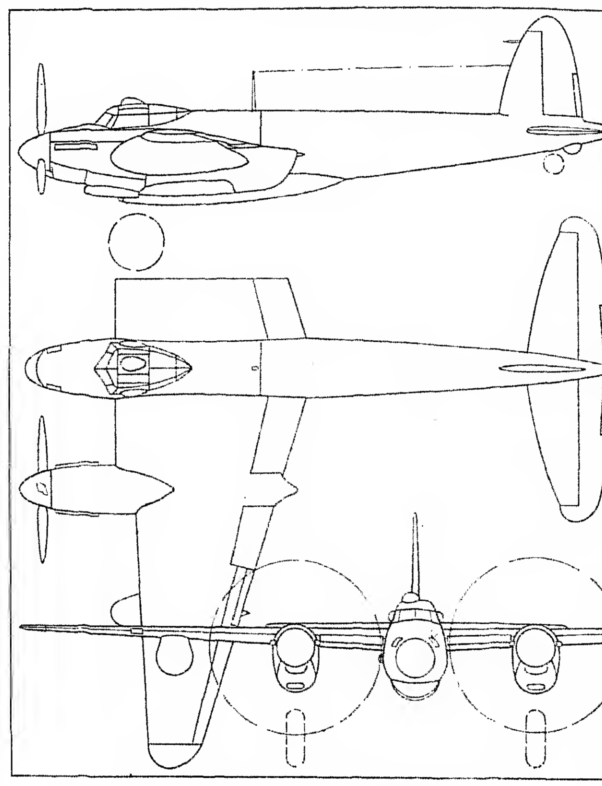
Mosquito P.R. Mk. 34. Very long-range photographic-reconnaissance version developed from the Mk. XVI. Rolls-Royce Merlin 76 or 113 (starboard) and 77 or 114 (port) engines, the port engine driving the cabin supercharger. Extra tanks in the expanded fuselage and two 200 Imp. gallon (910 litre) external wing tanks. Total tankage 1,267 Imp. gallons (5,763 litres).

Mosquito B. Mk. 35. High-altitude development of the B. Mk. XVI. Rolls-Royce Merlin 113/114 engines. Bomb load, one 4,000 lb. (1,814 kg.) bomb when fitted with two 50 Imp. gallon (227 litre) drop-tanks, or four 500 lb. (227 kg.) bombs with two 100 Imp. gallon (454 litre) drop-tanks.

Mosquito N.F. Mk. 36. Development of N.F. Mk. 30 with Rolls-Royce Merlin 113 engines.

Mosquito F.B. Mk. 41. Similar to F.B. Mk. 40 but fitted with Packard Merlin 69 engines with two-stage superchargers.

Mosquito T. Mk. 43. Trainer version. Identical to British T. Mk. III but fitted with dual elevator trim.



The D.H. Mosquito P.R. Mk. 34.

TYPE.—High-performance Military monoplane.

WINGS.—Mid-wing cantilever monoplane. Piercy aerofoil section (R.A.F. 34 with modified camber). One piece wing with slightly swept-back leading-edge and sharply tapered trailing-edge. Centre portion of wing carries the engine mountings and radiators. All-wood structure comprising two box spars with laminated spruce flanges and plywood webs, spruce and plywood compression ribs, spanwise spruce stringers and a plywood skin which in the case of the upper surface is double with the upper stringers sandwiched between the two skins. A false leading-edge, built up of nose rib formers and a D-skin, is attached to the front spar. The whole wing is screwed, glued and pinned and finally covered with fabric over the plywood. Incidence 1½ degrees, dihedral (on top of front spar) 1 degree 24 min. Sweep-back at rib No. 4 2½ degrees. Root chord (at 25 in.=63.5 c/m. from centre-line) 12 ft. 3 in. (3.73 m.) Tip chord (at 25 ft.=7.62 m. from centre-line) 3 ft. 10 in. (1.17 m.). Hydraulically-operated slotted flaps between ailerons and engine nacelles and between nacelles and fuselage. Total flap area 34.4 sq. ft. (3.18 sq. m.). Maximum depression 45 degrees. Slotted ailerons with controllable trim-tab in port aileron. Total aileron area 34.4 sq. ft. (3.18 sq. m.). Aileron movement 26½ degrees up, 11½ degrees down. Tab area 1.1 sq. ft. (0.1 sq. m.). tab movement 8½ degrees up, 9¼ degrees down. Gross wing area 454 sq. ft. (42.2 sq. m.).

FUSELAGE.—Oval-section all-wood structure jig-built in two vertical halves, each completely equipped before joining. Seven bulkheads built up of two plywood skins kept apart by spruce blocks, carry the outer skin which is a sandwich of balsa wood between two layers of plywood. At the points where bulkheads are attached the balsa core is replaced by a spruce ring. Where attachments are made to the skin a bakelite plug is inserted into the balsa, a plywood flange glued to the inner surface distributing the load. The two halves of the fuselage are scarfed together with Vee notches reinforced by ply inserts above and below and an additional overlapping ply strip on the inside of the joint. After assembly the whole fuselage is covered with fabric and doped. The underside of the fuselage is cut out to accommodate the wing, which is attached to four massive pick-up points, the lower portion of the cut-out section being replaced after assembly.

TAIL UNIT.—Cantilever monoplane type. All-wood structure with plywood-covered fixed surfaces and fabric-covered rudder and elevators. Aerodynamically and statically-balanced control surfaces. Automatic rudder bias by spring-loaded telescopic strut linked to the trimming-tab. Controllable trim-tabs in elevators. Tailplane span 20 ft. 9 in. (6.33 m.), Tailplane and elevator chord 5 ft. 6.3 in. (1.68 m.), Tailplane area (including fuselage) 44.98 sq. ft. (4.16 sq. m.), Elevator area (total) 34.08 sq. ft. (3.15 sq. m.), Elevator movement 25 degrees up and down, Elevator tab area (each) 1.53 sq. ft. (0.13 sq. m.), Tab movement 7½ degrees up and down, Fin area 13.3 sq. ft. (1.23 sq. m.), Rudder area (total) 16 sq. ft. (1.49 sq. m.), Rudder movement 25 degrees each way, Rudder trim and balance tab area 1.16 sq. ft. (0.106 sq. m.), Rudder tab movement 16 degrees either way.

LANDING GEAR.—Retractable type. Each unit consists of a pair of legs incorporating rubber-in-compression springing and carrying between them one large diameter wheel. The units are retracted hydraulically into the tails of the engine nacelles, hinged doors closing the apertures when the wheels are raised. Track 16 ft. 4 in. (4.98 m.). Hydraulic wheel-brakes. Dunlop-Marstrand non-shimmying retractable tail-wheel.

POWER PLANT.—Two Rolls-Royce Merlin twelve-cylinder Vee liquid-cooled engines on welded steel-tube mountings cantilevered from the wing spars. D.H. three-blade constant-speed full-feathering airscrews 12 ft. (3.66 m.) diameter. Radiators housed within the thickness of the wing inboard of the nacelles with the inlets along the leading-edge and the outlets controlled by flaps under the wing surface ahead of the front spar. Each radiator is divided into three parts, the outboard section forming the oil cooler, the middle section the coolant radiator and the inboard section the cabin heater. To accommodate the radiators the leading-edge of the wing between the fuselage and nacelles is set forward 22 inches (56 c/m.). Fuel carried in ten protected tanks, two (68 Imp. gallons=309 litres each) in the fuselage between the wing spars, two (79 and 65 Imp. gallons=359 and 295 litres each) on either side of the fuselage, inboard of the nacelles, and two (32 and 24 Imp. gallons=145 and 109 litres each) outboard of each nacelle. Total normal fuel capacity 536 Imp. gallons (2,434 litres). The long-range versions of the Mosquito have three additional tanks, one in the fuselage and two mounted externally under the wing outboard of the nacelles. These latter tanks are of various capacities and are jettisonable.

ACCOMMODATION (Fighter and Fighter-Bomber).—Side-by-side seating for crew of two in nose with pilot on port side. Armoured bulkhead in solid nose and flat bullet-proof windscreen. Entrance to cockpit through door on starboard side.

ACCOMMODATION (Unarmed Bomber and Photographic Reconnaissance).—Accommodation for crew of two as for Fighter. Transparent nose with optically-flat panel for bomb-aimer, Vee windscreen with two layers of glass between which passes constant flow of dried air to prevent misting and icing, and spectacle-type control instead of stick-type column in Fighter. Entrance to cabin through hatch in floor. Supercharged and heated cabin in Mks. 34 and 35.

ARMAMENT (Fighter).—Four 0.303 in. (7.7 m/m.) Browning machine-guns in solid nose ahead of armour bulkhead and four 20 m/m. British Hispano cannon in lower portion of fuselage and firing through apertures in underside of nose. In certain marks machine-guns replaced by radar.

ARMAMENT (Unarmed Bomber).—No armament. Internal bomb stowage in fuselage and racks beneath outer wings. Maximum bomb load 4,000 lbs. (1,814 kg.). Bomb sights and selector switches in nose. Bomb-aimer's panel has double glass with heated air passing between, as well as an external jet for spraying de-icing fluid thereon.

ARMAMENT (Fighter-Bomber).—Armament as for Fighter. Bomb-bay equal to rear half of Bomber. Internal stowage for 1,000 lbs. (454 kg.). Racks under wings for two additional 500 lb. (227 kg.) bombs. Total bomb load 2,000 lbs. (907 kg.).

ARMAMENT (Photographic-Reconnaissance).—None carried.

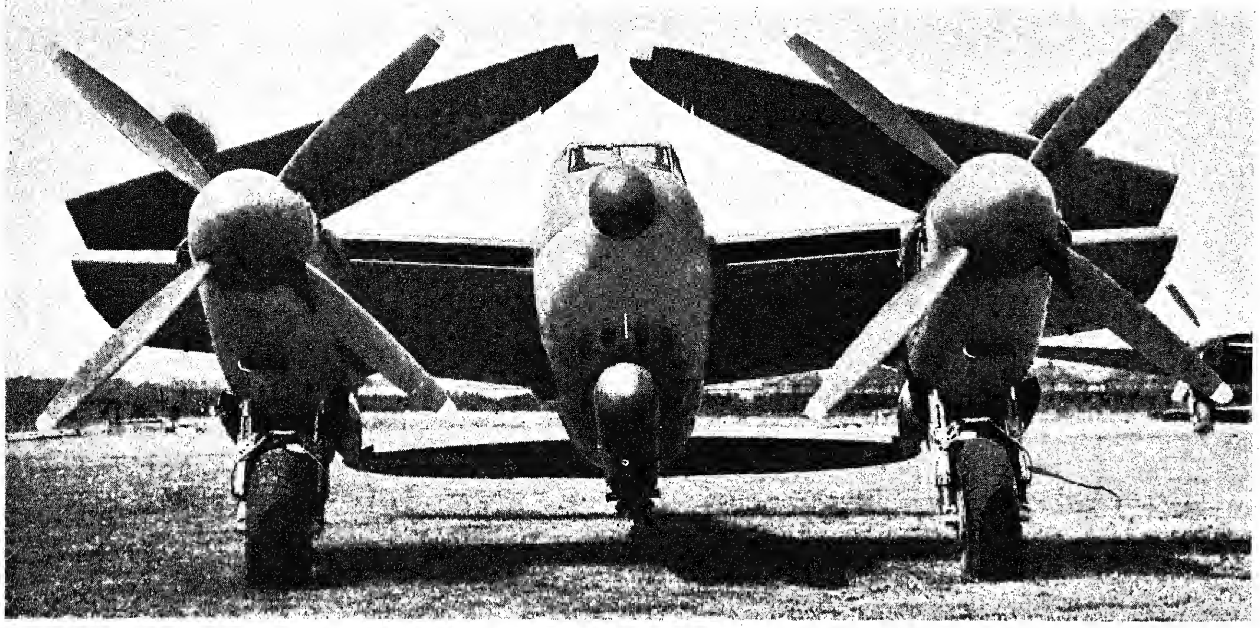
EQUIPMENT (Fighter).—Full radio and electrical equipment, oxygen, cabin heating, stowage for dinghy in roof of fuselage aft of canopy, etc.

EQUIPMENT (Unarmed Bomber).—Camera installation in rear fuselage between bulk-heads 5 and 6, with remote control from bomb-aimer's position.

EQUIPMENT (Photographic-Reconnaissance).—Comprehensive camera installation comprising both vertical and oblique cameras. All are electrically-operated and heated. For vertical photography normal bomb sights are used and cameras controlled by observer. For oblique photography pilot is responsible and sighting marks are provided on the side of cockpit canopy and on upper surface of port wing.

DIMENSIONS.—Span 54 ft. 2 in. (16.52 m.), Length 44 ft. 6 in. (13.57 m.). Height (over rudder in flying position) 17 ft. 5 in. (5.3 m.).

WEIGHTS AND LOADING (Mk. 34).—Weight empty 14,622 lb. (6,632 kg.), Normal loaded weight 22,587 lbs. (10,245 kg.), Wing loading 49.7 lbs./sq. ft. (242.6 kg./sq. m.).



The D.H. Sea Mosquito Mk. 33 Naval Torpedo-Fighter-Reconnaissance Monoplane (two 1,635 h.p. Rolls-Royce Merlin 25 engines).

WEIGHTS AND LOADINGS (Mk. 35).—Weight empty 17,028 lbs. (7,724 kg.), Weight loaded 25,200 lbs. (11,430 kg.), Wing loading 56 lbs./sq. ft. (273.4 kg./sq. m.). Power loading (take-off) 8.2 lbs./h.p. (3.76 kg./h.p.).

WEIGHTS AND LOADINGS (Mk. 36).—Weight empty 18,229 lbs. (8,268 kg.), Weight loaded 21,400 lbs. (9.707 kg.), Wing loading 47 lbs./sq. ft. (229.4 kg./sq. m.), Power loading (take-off) 6.96 lbs./h.p. (3.18 kg./h.p.).

PERFORMANCE (Mk. 34).—Maximum speed 425 m.p.h. (684 km.h.), Cruising speed 315 m.p.h. (507 km.h.) at 30,000 ft. (9,145 m.), Maximum still-air range 3,500 miles (5,635 km.), Normal still-air range (approx.) 2,335 miles (3,758 km.).

PERFORMANCE (Mk. 35).—Maximum speed 425 m.p.h. (684 km.h.) at 30,500 ft. (9,295 m.), Operational ceiling 36,000 ft. (10,975 m.).

PERFORMANCE (Mk. 36).—Maximum speed 404 m.p.h. (646.4 km.h.) at 30,000 ft. (9,145 m.), Operational ceiling 36,000 ft. (10,975 m.).

THE D.H. 98 SEA MOSQUITO.

The Sea Mosquito is the naval adaptation of the R.A.F. Mosquito fighter-bomber, this version being Mk. 33 in the Mosquito Series.

For Naval use a number of modifications have been incorporated. These include folding wings, arrester gear and a new oleo-pneumatic landing-gear in place of the standard rubber-in compression gear which was prone to excessive rebound in landing on carrier decks and liable to cause the arrester hook to bounce over the arrester wires.

The standard armament of the Sea Mosquito consists of four 20 m/m. cannon. The bomb load may consist of two 500-lb. (227 kg.) bombs in the rear half of the bomb-bay and two 500 lb. (227 kg.) bombs under the wings. Eight 60 lb. (27 kg.) rockets four under each wing, can also be carried. Crutches are fitted under the fuselage for one standard torpedo. Specialised naval radar equipment is installed in the nose.

The power-plant consists of two 1,635 h.p. Rolls-Royce Merlin 25 engines, each driving a D.H. Hydromatic four-blade constant-speed full-feathering airscrew.

A number of R.A.F. Mosquitos were converted for Naval training pending the development of the Sea Mosquito, and with some of these aircraft satisfactory preliminary deck landing trials were made. Further trials were later completed with the prototype Sea Mosquito.

Rocket-assisted take-off gear has been developed and is installed in the production aircraft.

DIMENSIONS.—As Mosquito.

WEIGHTS AND LOADINGS.—Weight empty 17,165 lbs. (7,786 kg.), Weight loaded 22,000 lbs. (9,979 kg.), Wing loading 49 lbs./sq. ft. (239.2 kg./sq. m.), Power loading (take-off) 6.78 lbs./h.p. (3.1 kg./c.v.).

PERFORMANCE.—Maximum speed 385 m.p.h. (619 km.h.) at 13,500 ft. (4,115 m.), Operational ceiling 30,000 ft. (9,145 m.), Range (with drop-tanks) 1,680 miles (2,690 km.).

THE D.H. 89A DRAGON RAPIDE.

The D.H.89 first appeared in 1934 and it has been in production continuously ever since, although it will probably have been finally withdrawn from production by the end of 1946.

Up to the outbreak of War 210 Dragon Rapides had been built and sold to aircraft operators in nearly every part of the World. Many civil Rapides were impressed into service for communications duties when war broke out, and production was maintained throughout the War, by the de Havilland company at Hatfield up to 1943 and thereafter by Brush Coachworks at Loughborough. Hatfield turned out about 200 and the Brush Coachworks built 275 up to August 15, 1945. The service name for the D.H.89 produced under Air Ministry contract was Dominie, and two versions were in service, the Dominie I wireless and navigational trainer and the Dominie C. Mk. II communications version.

After the war civil production was resumed and three versions now in service are distinguished as follows :—

Dragon Rapide Mk. I. Pre-war D.H.89 with two D.H. Gipsy-Six engines and accommodation for pilot and eight passengers.

Dragon Rapide Mk. II. Post-war production with two D.H. Gipsy Queen III engines and accommodation for pilot, radio-operator and six passengers.

Dragon Rapide Mk. III. Post-war production similar to the Mk. I but fitted with two D.H. Gipsy Queen III engines.

A D.H. Dragon Rapide (two D.H. Gipsy Queen engines) delivered to "Zone Redningskorp," the Danish First Aid Organization.

DE HAVILLAND—*continued.*

TYPE.—Twin-engined Passenger or Freight-carrier.

WINGS.—Equal-span two-bay braced biplane. Aerofoil section Modified R.A.F. 34. Upper wings, attaching direct to top of fuselage, have two spindled spruce spars, spruce girder ribs, tubular drag-struts, and internal wire bracing. Plywood leading-edge and fabric covering over all. Lower wings in four sections consisting of two stub wings and two outer sections. Lower wing stubs have tubular spars continuing through fuselage under cabin floor and are braced from ends to top of fuselage by one pair of streamlined steel-tube struts each side. Outer sections constructed as upper wings. Streamlined parallel steel-tube interplane struts between bays and single built-up steel-tube strut at tips. Duplicated lift and anti-lift wires in plane of front spars only. Incidence 3 degrees, Dihedral (upper wings from root, and outer sections of lower wings) 3 degrees, Root chord 5 ft. 6 in. (1.67 m.) Mean chord 3 ft. 10.6 in. (1.18 m.), Aspect ratio 11.7. Ply-covered wooden ailerons with fabric over all on upper and lower wings interconnected by push-pull rods inside outer interplane strut. Total aileron area 29.2 sq. ft. (2.69 sq. m.). Manually-operated split trailing-edge flaps on lower wings on either side of each engine nacelle. Gross wing area 336 sq. ft. (31.2 sq. m.).

FUSELAGE.—Box-type structure with spruce longerons and struts inside plywood covering, except for floor which is clear of any projection, the whole being faired externally with fabric. Loads from upper front spars taken by tube across fuselage; from upper rear spars by wooden beam, and from lower spars by tubes athwart fuselage beneath floor. Steel joint plates. All fittings taking wing loads are steel forgings. Maximum exterior width 4 ft. 5 in. (1.35 m.).

TAIL UNIT.—Wire-braced monoplane type. Spruce structure with ply-covered tailplane and fin (over which is a covering of fabric) and fabric-covered elevators and rudder. Horn-balanced rudder; elevators unbalanced. Tailplane adjustable for incidence in air by screw-jack beneath front spar. Tailplane span (overall) 11 ft. 9 in. (3.58 m.), Maximum tailplane chord 2 ft. 10 in. (0.86 m.), Tailplane area 19.53 sq. ft. (1.81 sq. m.), Maximum elevator chord 2 ft. (0.61 m.), Elevator area (total) 17.4 sq. ft. (1.62 sq. m.), Fin area 9.7 sq. ft. (0.9 sq. m.), Rudder height 6 ft. 10 in. (2.08 m.), Rudder area 16.5 sq. ft. (1.53 sq. m.).

LANDING GEAR.—Fixed two-wheel type. Each main wheel carried between pair of Dowty shock-absorber legs and faired into engine cowling with removable metal sheets. Non-moving parts of shock-absorbers rigidly-braced to wing structure and to lower fuselage longerons. Medium-pressure tyres. Bendix wheel brakes. Track 11 ft. 6 in. (3.5 m.). Castering tail-wheel.

POWER PLANT.—Two de Havilland Gipsy Queen III six-cylinder in-line inverted air-cooled direct-drive engines rated at 180/185 h.p. at 2,100 r.p.m. at sea level, and with a maximum output of 198/203 h.p. at 2,350 r.p.m. Engines mounted on welded steel-tube bearers in front of lower stub-wings. Engine centres 11 ft. 6 in. (3.5 m.). Fairey-Reed 61186A/21/X4 or 61186A/21/X9 two-blade fixed-pitch metal airscrews. Two fuel tanks, each of 38 Imp. gallons (173 litres) capacity, one behind each engine in wings. Structural provision for installation of two 18 Imp. gallon (82 litre) auxiliary tanks in cabin. One 4½ Imp. gallon (19.5 litre) oil-tank in each nacelle, cooled by scoops in slipstream.

ACCOMMODATION (Mk. II).—Pilot centrally-seated in cockpit, with radio-operator behind and to starboard, separated from main cabin by bulkhead. Main cabin 10 ft. long × 4 ft. 6 in. high × 4 ft. wide (3.05 m. × 1.4 m. × 1.2 m.) has capacity of 180 cub. ft. (5.1 cub. m.). Six quickly-removable seats, three on each side with central aisle. Rear starboard seat may be replaced by toilet compartment of 23 cub. ft. (0.65 cub. m.) capacity. Access door to main cabin on port side of fuselage between trailing-edges of wings. Luggage compartment aft with capacity of 27 cub. ft. (0.76 cub. m.). Access door on starboard side of fuselage.

ACCOMMODATION (Mk. III).—Bulkhead at rear of pilot's compartment moved forward 2 ft. (0.61 m.). No radio-operator carried. Passenger cabin has capacity of 216 cub. ft. (6.1 cub. m.) and accommodation for eight passengers, the rear starboard seat being removable to provide toilet accommodation as an Mk. II. Luggage compartment as Mk. II.

EQUIPMENT.—12 volt electric system, powered by Marconi wind-driven generator in port upper wing leading-edge. Provision for Marconi AD 41/50 or AD 87/8882 radio with or without Standard Blind Approach.

DIMENSIONS.—Span 48 ft. (14.63 m.), Length 34 ft. 6 in. (10.52 m.), Height 10 ft. 3 in. (3.3 m.).

WEIGHTS AND LOADINGS (Mk. II).—Weight empty (equipped, except chairs) 3,555 lbs. (1,614 kg.), Disposable load 1,995 lbs. (906 kg.), Disposable load (with Fairey-Reed 61186A/21/X9 airscrews) 2,195 lbs. (996 kg.), weight loaded 5,550 lbs. (2,520 kg.). Weight loaded (with Fairey-Reed 61186A/21/X9 airscrews) 5,750 lbs. (2,611 kg.), Wing loading (normal) 16.5 lbs./sq. ft. (80.5 kg./sq. m.). Power loading (at 200 h.p. per engine) 13.8 lbs./h.p. (6.32 kg./c.v.).

WEIGHTS AND LOADINGS (Mk. III).—Weight empty (equipped, except chairs) 3,520 lbs. (1,599 kg.), Disposable load 2,030 lbs. (921 kg.), Disposable load (with Fairey-Reed 61186A/21/X9 airscrews) 2,230 lbs. (1,111 kg.), Weight loaded 5,550 lbs. (2,520 kg.), Weight loaded (with Fairey-Reed 61186A/21/X9 airscrews) 5,750 lbs. (2,611 kg.), Maximum wing loading 17.1 lbs./sq. ft. (83.49 kg./sq. m.). Power loading (maximum at 200 h.p. per engine) 14.3 lbs./h.p. (6.55 kg./c.v.).

PERFORMANCE (Mk. II at 5,550 lbs.=2,520 kg.).—Maximum speed 147 m.p.h. (236 km.h.) at sea level, Cruising speed 130 m.p.h. (209 km.h.) at 1,000 ft. (305 m.) at 2,100 r.p.m., Initial rate of climb 870 ft./min. (265 m./min.), Service ceiling 16,700 ft. (5,100 m.), One-engine ceiling 1,000 ft. (305 m.), Climb to 5,000 ft. (1,525 m.) 6.8 minutes, Climb to 10,000 ft. (3,050 m.) 17 minutes, Still-air range (with 76 Imp. gallons=346 litres) 475 miles (764 km.), Take-off distance to 50 ft. (15 m.) in still air 512 yds. (468 m.), Landing distance from 50 ft. (15 m.) in still-air 420 yds. (384 m.), Fuel consumption 20 Imp. gallons/hr. (9.1 litres/hr.)=6.5 m.p.g. (2.3 km. litre).

PERFORMANCE (Mk. III at 5,750 lbs.=2,611 kg.).—Maximum speed 141 m.p.h. (226 km.h.) at sea level, Cruising speed 123 m.p.h. (198 km.h.) at 1,000 ft. (305 m.) at 2,100 r.p.m., Initial rate of climb 860 ft./min. (262 m./min.), Service ceiling 16,500 ft. (5,040 m.), One-engine ceiling 1,000 ft. (305 m.), Climb to 5,000 ft. (1,525 m.) 6.9 minutes, Climb to 10,000 ft. (3,050 m.) 17.2 minutes, Still-air range (with 76 Imp. gallons=346 litres) 495 miles (795 km.), Take-off distance to 50 ft. (15 m.) in still air 535 yds. (488 m.), Landing distance from 50 ft. (15 m.) in still air 430 yds. (392 m.), Fuel consumption 18 Imp. gallons/hr. (82 litres/hr.)=6.8 m.p.g. (2.4 km. per litre).

FAIREY.

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Chief Designer: D. L. Hollis-Williams, B.Sc., F.R.Ae.S.

The Fairey Aviation Co., Ltd. is well known as the producer of a wide variety of military aircraft. It has specialised on naval types for many years, although not to the exclusion of aircraft suitable for other purposes.

The types of Fairey aircraft in service in the Royal Navy at

A Model of the Fairey FB-1 Gyrodyne Four-seat Helicopter.

***FAIREY**—continued.*

the war's end were Firefly, Barracuda and Swordfish, the first two as first-line carrier aircraft, and the Swordfish, with some survivors of earlier Fairey operational types, in a multiplicity of non-operational capacities—mainly training.

The production of aircraft of Fairey design from the beginning of the expansion period prior to the war and up to VJ-Day may be summarised as follows :—

Battle. 2,419 (1,250 by the Austin Shadow Factory 1937-41).

Swordfish. 2,390 (690 by Fairey 1935-40, 1,700 by Blackburn 1940-45).

Albacore. 802 (1939-42).

Fulmar. 600 (1940-43).

Barracuda. 1,072 (including aircraft built by Blackburn and Boulton & Paul 1940-V.J-Day). Production continued by Fairey after VJ-Day.

Firefly. 574 (1942-VJ-Day). Production continued after VJ-Day.

In addition Fairey factories built 500 Beaufighter twin-engined fighters and 661 Halifax four-engined bombers.

The current production types are the Spearfish and Firefly. In September, 1946, the Firefly Trainer was announced. The Barracuda, in production at the beginning of 1946, was due to pass out of production during the year.

In 1946 the Company announced that it was entering the rotating-wing field with a craft known as the Gyrodyne, a cross between the helicopter and the Autogiro in that it will employ a mechanically-driven rotor and at the same time incorporate devices designed to give the high safety factor achieved in the Autogiro type of rotorplane. Dr. J. A. J. Bennett, B.Sc., M.A., Ph.D., formally Research Engineer with the Cierva Autogiro Company has joined the Company and takes charge of the development.

THE FAIREY FB-1 GYRODYNE.

The Gyrodyne is an experimental helicopter which at the time of writing was under construction for research purposes. It is unusual in arrangement in that it combines a three-blade main rotor and an orthodox two-blade tractor airscrew for forward flight, both of which are driven by a 500 h.p. Alvis Leonides nine-cylinder radial air-cooled engine mounted in the fuselage. It has a short-span cantilever wing mounted half-way up the fuselage, with the tractor airscrew carried in a small nacelle at its starboard extremity. The tail-unit consists of a cantilever tailplane with twin fins and rudders mounted as endplates, and the landing gear is of the tricycle type.

The Gyrodyne is projected in military and civil forms, and the latter will have an enclosed cabin in the nose seating a pilot and one passenger side-by-side, with a full-width seat behind for two further passengers. No other details were available for publication at the time of closing for press.

THE FAIREY FIREFLY.

The Firefly was designed to Specification N5/40, which was in reality a combination of specifications N8/39 and N9/39 suggested by the Fairey Company. The first prototype flew on December 22, 1941, less than eighteen months after the mock-up conference and receipt of the production contract. The first production Firefly Mk. I flew on August 26, 1942.

The Mks. I and IV are the principal production models and in addition to being supplied in quantity to the Royal Navy, both have been standardised by the Royal Netherlands Naval Air Service.

The following versions of the Firefly have been built :—

Firefly F. Mk. I. 2,000 h.p. Rolls-Royce Griffon II or XII engine driving a Rotol three-blade airscrew. Day Fighter and (later) Day and Night Fighter (see under Mk. II.).

Firefly N.F. Mk. II. Designed as a Night Fighter incorporating an early form of radar. To give better night-flying stability the engine was moved forward 18 in. (45.7 c/m.), otherwise similar to Mk. I except for specialised equipment. It was later found that improved radar could be installed in Mk. I, which could thus be used for both D.F. and N.F. duties. Therefore, the Mk. II faded out and later versions of Mk. I went into quantity production equipped with the Griffon XII engine.

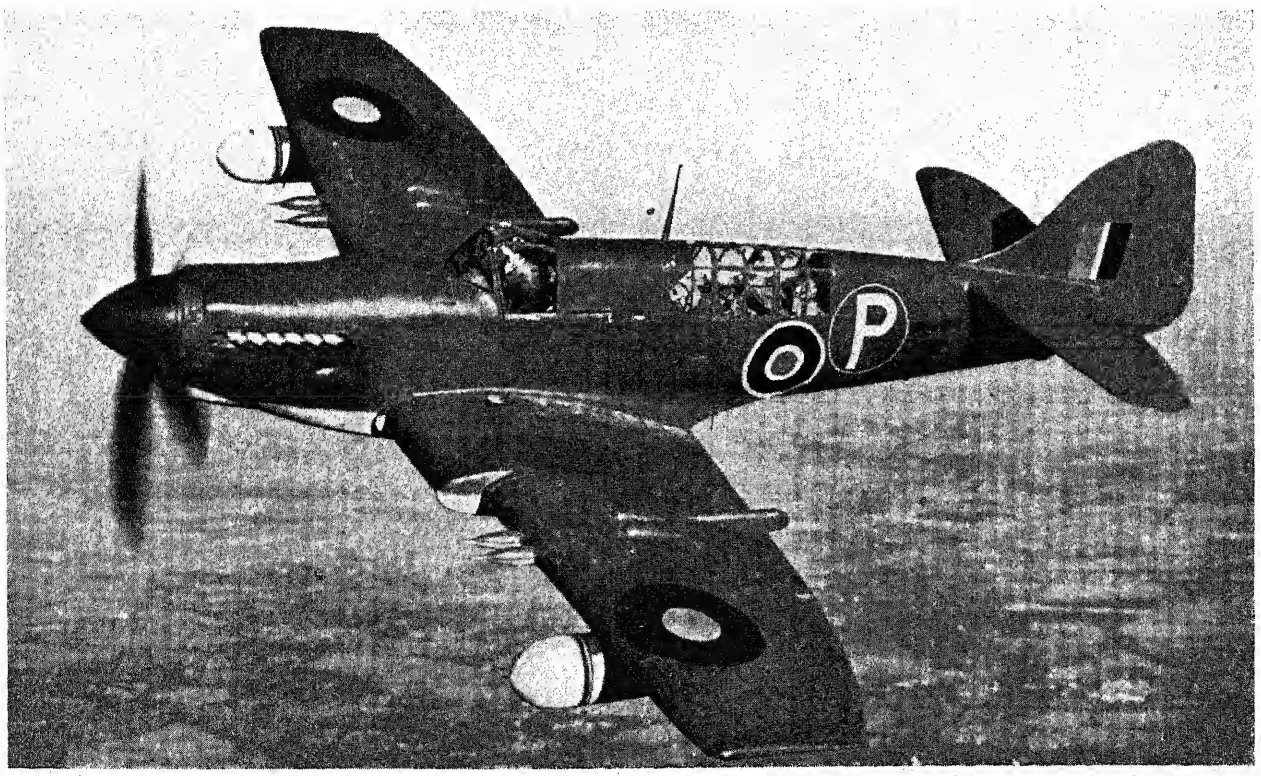
Firefly III. Designed to take the two-stage Griffon engine. Fitted with orthodox underslung nose radiator in a bulbous crescent-shaped duct. This design affected the longitudinal control adversely and called for a re-design of the front end, resulting in the Mk. IV.

Firefly IV. Rolls-Royce Griffon 72 (in two prototypes) or 74 (in production version) driving Rotol four-blade airscrew. Radiators moved from beneath nose to leading-edge extensions of centre-section. Wings reduced in span and given square tips. Increased fin area. Auxiliary fuel tanks moved from leading-edge to external position beneath wing, and to balance this external fitting the external radar equipment, which is carried beneath centre-section in Mk. I, moved to a position beneath the other wing in housing of similar shape to drop tank. Armament same as Mk. I but can carry in addition bombs of various sizes up to 1,000 lbs. (454 kg.) (maximum 2 × 1,000 lbs. = 454 kg.), sixteen 60-lb. (27 kg.) rockets or eight heavier rockets, or long-range drop tanks on bomb pick-up points. The production Mk. IV is 40 m.p.h. (64 km.h.) faster than the Mk. III and 70 m.p.h. (112 km.h.) faster than Mk. I. First production Mk. IV flew on May 25, 1945. The description below refers to the Mk. IV.

TYPE.—Two-seat Long-Range Naval Reconnaissance Fighter.

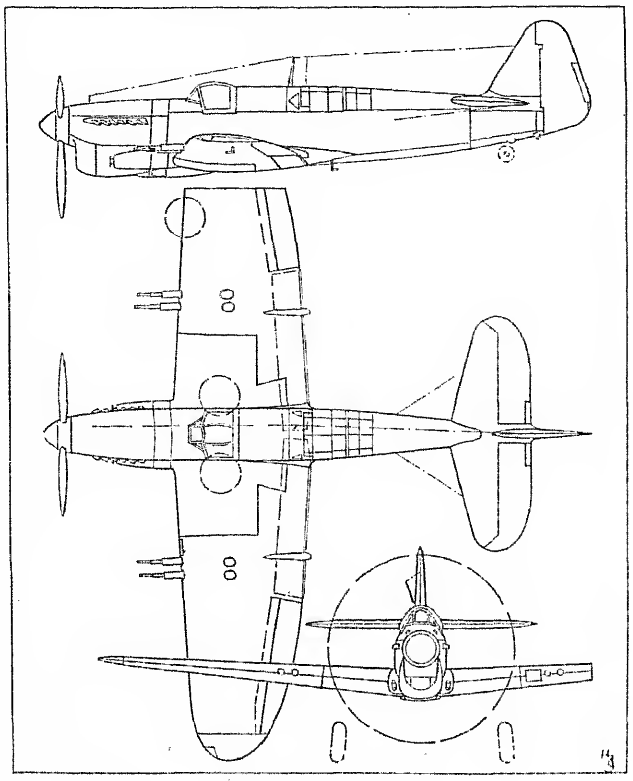
WINGS.—Low-wing cantilever monoplane. One-piece centre-section back to rear spar fits into recess in underside of fuselage. Folding outer sections have trailing-edge portions extending inwardly to the fuselage centre-line. Wings, which are folded manually, are turned upward round rear spar universal hinges and swung backward to lie, trailing-edge down, along sides of fuselage. Wings are locked in flying position hydraulically. All-metal wing structure with stressed metal skin. Retractable Youngman aerofoil flaps beneath trailing-edge from ailerons to centre-line of fuselage. Flaps may be swung down and set to give varying positions for take-off, cruising and landing. Hydraulic operation. Trim-tab in port aileron. Gross wing area 330 sq. ft. (30.65 sq. m.).

FUSELAGE.—Oval section metal semi-monocoque structure with smooth metal skin. Engine mounting bolts on to front bulkhead, and tubular tail wedge on to rear bulkhead.



The prototype Fairey Firefly IV Naval Reconnaissance Fighter (2,300 h.p. Rolls-Royce Griffon 72 engine).— *(Charles Brown).*

***FAIREY**—continued.*



The Fairey Firefly I.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with metal-covered fin, tailplane and elevators and fabric-covered rudder. Trim-tabs in all movable surfaces.

LANDING GEAR.—Retractable type. Wheels and oleo shock-absorber struts, hinged at the extremities of the centre-section front spar, retract inwardly into wells in the underside of the centre-section between the spars, fairing plates on the oleo legs and hinged doors under the centre-section closing the apertures when the gear is raised. Fully-retractable tail-wheel. Hydraulic operation with emergency hydraulic hand pump. Retractable deck arrester hook under rear fuselage. Catapult points in fuselage are retractable at the front station and removable at the rear.

POWER PLANT.—One 2,300 h.p. Rolls-Royce Griffon 74 twelve-cylinder vee liquid-cooled engine driving a Rotol four-blade constant-speed airscrew. Radiators in leading-edge of centre-section, with thermostatically-controlled mechanically-interconnected flaps at exit ducts. Main self-sealing fuel tank in fuselage behind pilot's cockpit. Auxiliary fuel tank carried beneath port outer wing and is balanced on opposite side by radar equipment carried in a similarly-shaped housing. Oil tank in centre-section.

ACCOMMODATION.—Pilot's cockpit over leading-edge of wing. Observer/radio-operator/navigator aft of trailing-edge of wing. Sliding and jettisonable canopies over both cockpits.

ARMAMENT.—Four 20 m/m. British Hispano cannon, two in the leading-edge of each outer wing. Provision for rocket projectile gear. (maximum 16 × 60 lbs.=27 kg. zero-length rockets). Bombs (maximum 2 × 1,000 lbs.=454 kg.) on external fittings under outer wings. Radar, radio, night-flying equipment, etc.

DIMENSIONS.—Span 41 ft. 2 in. (12.55 m.), Length 37 ft. 11 in. (11.56 m.), Height (tail down, one airscrew blade vertical) 14 ft. 4 in. (4.37 m.).

WEIGHTS AND LOADINGS.—Normal loaded weight 13,450 lbs. (6,106 kg.), Maximum loaded weight (with two 45 gallon overload tanks) 14,200 lbs. (6,446 kg.), Wing loading (maximum) 43 lbs./sq. ft. (210 kg./sq. m.), Power loading (maximum weight) 6.1 lbs./sq. ft. (2.76 kg./h.p.).

PERFORMANCE.—Maximum speed 386 m.p.h. (618 km.h.) at 14,000 ft. (4,270 m.), Climb to 10,000 ft. (3,050 m.) 7 min. 9 sec., Climb to 20,000 ft. (6,095 m.) 10 min. 30 sec., Range with standard tankage 735 miles (1,180 km.), Maximum range (with drop tanks) 1,070 miles (1,720 km.).

THE FAIREY FIREFLY TRAINER.

A special version of the Firefly has been developed to serve as an intermediate instructional aircraft between advanced trainers and combat types. The Firefly Trainer is a conversion of the F. Mk. I. The cockpit arrangement has been modified so that the rear cockpit, occupied by the instructor, is 12 in. (30.5 c/m.) above the level of the forward cockpit occupied by the pupil. Dual controls are fitted. Operational equipment is retained except that only two wing cannon are installed, one in each wing.

The power-plant consists of a Rolls-Royce Griffon XII engine driving a Rotol three-blade airscrew.

DIMENSIONS.—Same as for Firefly F.Mk.I.

WEIGHT LOADED.—12,000 lb. (5,443 kg.).

PERFORMANCE (Trainer).—Maximum speed 305 m.p.h. (490 km.h.) at 16,500 ft. (5,030 m.), Speed at sea level 283 m.p.h. (455 km.h.), Speed at 1,500 ft. (460 m.) 287 m.p.h. (462 km.h.), Speed at 20,000 ft. (6,095 m.) 300 m.p.h. (482 km.h.), Climb to 5,000 ft. (1,525 m.) 2 minutes 35 seconds, Climb to 10,000 ft. (3,050 m.) 5¾ minutes, Climb to 15,000 ft. (4,570 m.) 9½ minutes, Service ceiling (with 192 Imp. gallons = 873 litres fuel) 28,000 ft. (8,535 m.), Range at 5,000 ft. (1,525 m.) 805 miles (1,295 km.), Take-off run in 27-knot (50 km.h.) wind 117 yds. (106 m.).

THE FAIREY SPEARFISH.

The Spearfish two-seat Torpedo/Dive-Bomber/Reconnaissance Monoplane was designed to Specification O.5/43. The prototype aircraft was powered by a Bristol Centaurus 57 engine, but this is replaced on the first ten production aircraft by a Centaurus 58 and on the next twenty-two by a Centaurus 59; thereafter the Centaurus 60 will be fitted.

A Rotol five-blade constant-speed airscrew is being used on current aircraft, but later a reversible-pitch airscrew will be fitted. Provision is also being made for later aircraft to be fitted with dive-brakes on the upper and lower wing surfaces.

TYPE.—Two-seat Torpedo/Dive-Bomber/Reconnaissance monoplane.

WINGS.—All-metal cantilever mid-wing monoplane. Two-spar structure built in three main sections; a centre-section integral with fuselage and two outer sections. Spars in centre-section have extruded light alloy booms to which alloy sheet webs and Z-section stiffeners are riveted. Auxiliary front spar and ribs at angle to main members. Outer wing spars have tapering L-section with L and Z-section web stiffeners. Auxiliary spar in trailing-edge section. Pressed sheet ribs and flush-riveted aluminium-alloy sheet covering. Outer wings have dihedral of 6 degrees, and are folded hydraulically about rear spar to lie alongside fuselage with leading-edge uppermost. Leading-edge sweepback 3 degrees. Aspect ratio 6.79. Gross wing area 530 sq. ft. (49.24 sq. m.). Short-span ailerons of metal construction and covering. Inset trim and servo-tabs. Aileron area (each) 19.25 sq. ft. (1.78 sq. m.). Retractable Fairey-Youngman all-metal flaps between ailerons and

The Fairey Firefly Two-seat Advanced Trainer (Rolls-Royce Griffon XII engine).—(*Charles Brown*).

FAIREY—*continued.*

fuselage in two sections each side. Flaps operated by six hydraulic jacks in shrouded link boxes aft of rear spar. Four flap positions: housed (flush); cruising 3 degrees 25 minutes; take-off 15 degrees 25 minutes; landing 35 degrees 25 minutes.

Fuselage.—Light alloy monocoque structure in three sections bolted together, comprising front fuselage to rear spar; rear fuselage to frame at leading-edge of fin, and rear wedge. Four light alloy extruded channel-section longerons, pressed sheet vertical frames and flush-riveted light-alloy skin.

Tail Unit.—Cantilever monoplane type. Metal construction with sheet metal covering over all surfaces except rudder, which has metal leading-edge and horn balance and fabric covering over remainder. Fin and tailplane bolted to top of rear wedge. Metal trim and servo-tabs in mass-balanced rudder and elevators. Elevators built in one piece with single through-spar. Tailplane span 20 ft. 0 in. (6.09 m.), Tailplane area 59.8 sq. ft. (5.55 sq. m.), Elevator area (total) 57 sq. ft. (5.29 sq. m.). Fin area 30.1 sq. ft. (2.79 sq. m.) rudder area 26.3 sq. ft. (2.44 sq. m.).

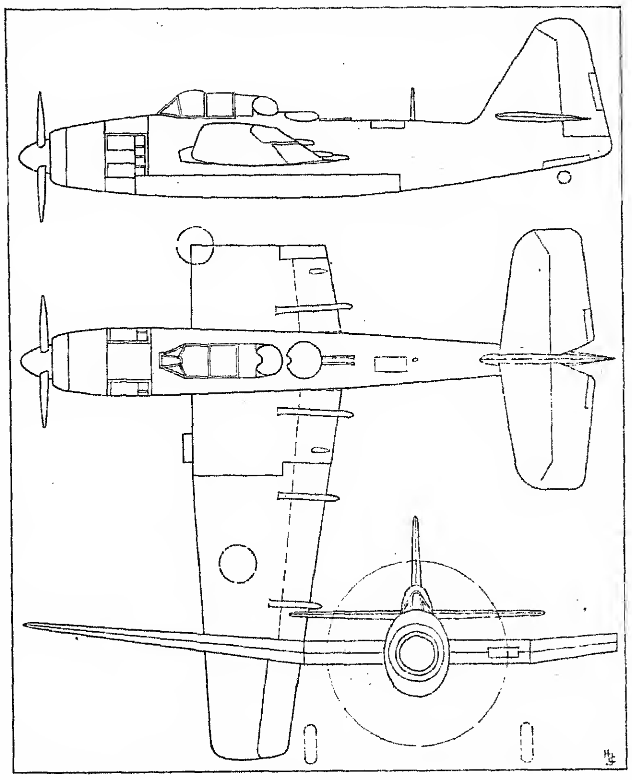
Landing Gear.—Retractable type. Main wheels carried in half-forks attached to oleo-pneumatic shock-absorber struts which retract outward into outer wings and are covered by fairing plates. Main legs and rear link members hinged to heavy light alloy forgings at ends of centre-section. Side link member attached to front spar in centre-section. Hydraulic operation, with emergency hand-pump. Dunlop wheels and brakes. Track 16 ft. 8 in. (5.08 m.) Dunlop tail-wheel carried in fork on Lockheed oleo-pneumatic shock-absorber strut with self-centering anti-shimmy device. Retracts backwards into fuselage and is enclosed by twin doors. Deck arrester hook hinged at extreme rear of fuselage and lies within port tail-wheel door. Snap mechanism with Bowden control.

Power Plant.—One Bristol Centaurus CE.58, 59 or 60 eighteen-cylinder two-row radial air-cooled engine on steel-tube bearers bolted to fire-proof bulkhead. Maximum level output (CE.58) 2,320 h.p. at 14,000 ft. (5,265 m.), Maximum weak mixture cruising output 1,535 h.p. at 21,250 ft. (6,475 m.) and with 2,800 h.p. (with methanol injection) for take-off. Rotol 24-blade engine-driven cooling fan. Rotol V.H.65 five-blade constant-speed airscrew, 14 ft. (4.26 m.) diameter. One self-sealing fuel tank (183 Imp. gallons=832 litres) in each centre-section with additional tank (43 Imp. gallons=195 litres) in leading-edge of starboard centre-section. Total normal capacity 409 Imp. gallons (1,860 litres). Maximum overload capacity 589 Imp. gallons (2,678 litres) with auxiliary tank (180 Imp. gallons=818 litres) in bomb-bay in place of bombs. Oil tank (29 Imp. gallons=132 litres) on engine bulkhead. Oil cooler intake in leading-edge of port centre-section. Coffman starter. Provision for R.A.T.O.G. using three or four units each side with mean thrust of 1,050 lbs. (476 kg.) each.

Accommodation.—Crew of two. Pilot's and observer's cockpits covered by short canopy of transparent plastic moulded construction stiffened with additional strips cemented on at edges and joints. Hydraulically-operated portions slide for access and are jettisonable. Bullet-proof windscreen. Armour-plated bulkhead behind pilot.

Armament.—Two .5-in. (12.7 m/m.) Browning forward-firing machine-guns mounted in each outer wing outboard of airscrew disc (150 or 400 r.p.g. in wings) and twin .5-in. (12.7 m/m.) Browning machine-guns (300 r.p.g.) in power driven remotely-controlled Frazer-Nash F.N.95 dorsal turret immediately aft of rear cockpit and operated by observer. GGS IIC sight. Fuselage bomb-bay fitted with hydraulically-operated twin doors has alternative accommodation for one 18-in. (45.72 c/m.) or 22-in. (55.88 c/m.) torpedo; four 500 lb. (227 kg.) bombs; one 2,000 lb. (907 kg.) bomb, or four depth-charges. Racks for eight Mk. VIII zero-length Rocket Projectiles under outer wings.

Equipment.—Retractable ASV XV radar scanner in fuselage aft of wing, and Rebecca IV; R/T between cockpits; camera in port



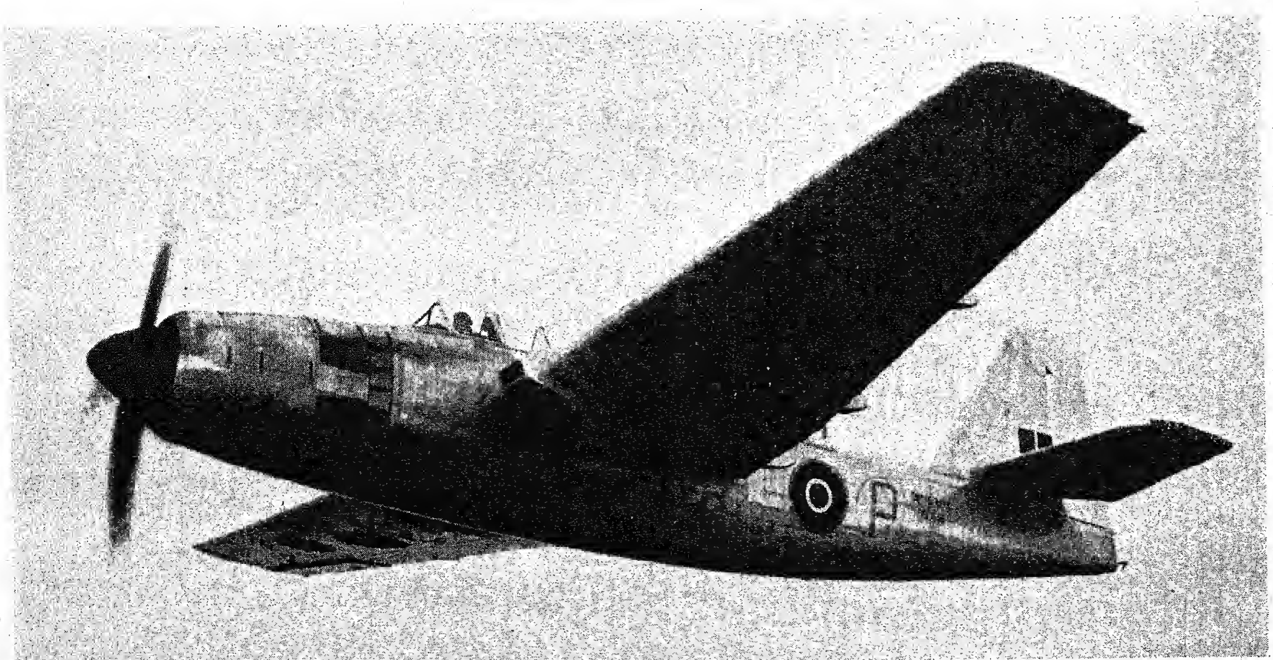
The Fairey Spearfish.

outer wing; collapsible dinghy in deck aft of turret; 30 multi-flares in bomb-bay as alternative to bomb load. Signal lamps; two oxygen bottles (or four when long-range tank fitted).

Dimensions.—Span 60 ft. 3 in. (18.36 m.), Width folded 19 ft. 6 in. (5.94 m.), Length (tail down) 44 ft. 7 in. (13.58 m.), Height (tail down, wings folded, airscrew optimum position) 16 ft. 4 in. (4.98 m.), Height (tail down, wings folded, airscrew running) 17 ft. 3 in. (5.25 m.).

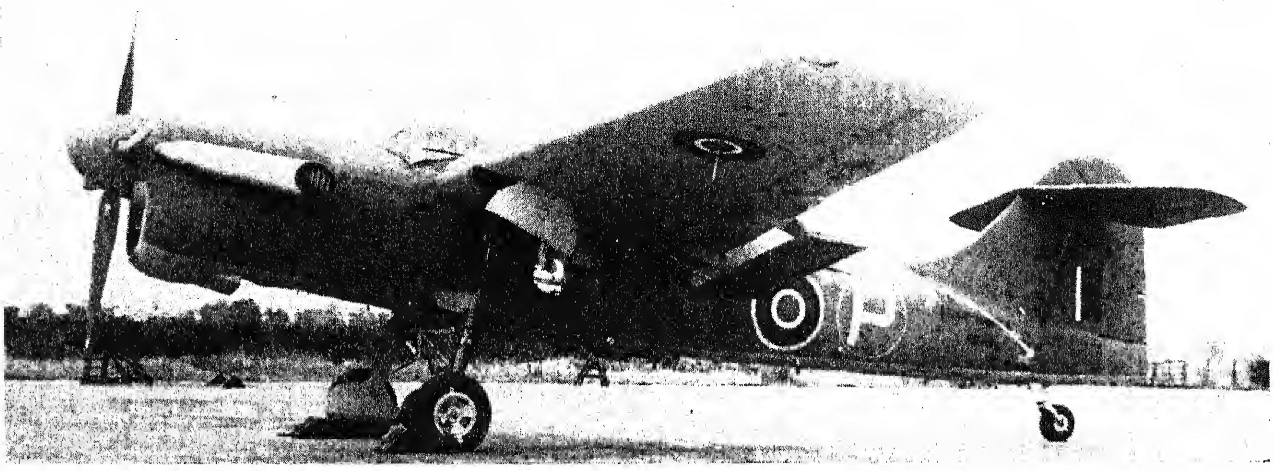
Weights and Loadings.—Normal weight loaded 21,642 lbs. (9,817 kg.). As bomber with four 500 lbs. (227 kg.) bombs 22,082 lbs. (10,016 kg.). With one 2,000 lbs. (907 kg.) bomb 22,010 lbs. (9,983 kg.). As torpedo bomber 22,021 lbs. (9,988 kg.). As long-range reconnaissance aircraft 21,882 lbs. (9,925 kg.). Wing loading (at 21,882 lbs.=9,925 kg.) 41.5 lbs./sq. ft. (200 kg./sq. m.), Power loading (at 21,882 lbs.=9,925 kgs., maximum weak mixture cruising output) 14.2 lbs./h.p. (6.4 kg./h.p.).

Performance.—Maximum speed 292 m.p.h. (470 km.h.) at 14,000 (5,265 m.) speed at 20,000 ft. (6,095 m.) 280 m.p.h. (450 km.h.), Speed at sea level 254 m.p.h. (409 km.h.), Economic cruising speed at 15,000 ft. (4,570 m.) 196 m.p.h. (315 km.h.), Climb to 5,000 ft. (1,525 m.) 3 minutes 40 seconds, Climb to 10,000 ft. (3,050 m.) 7 minutes 45 seconds, Climb to 20,000 ft. (6,095 m.) 19 minutes



The Fairey Spearfish Two-seat Torpedo-Dive-Bomber-Reconnaissance Monoplane (Bristol Centaurus 57 engine)—(*Charles Brown*).

FAIREY—*continued.*



The Fairey Barracuda V Torpedo-Bomber (Rolls-Royce Griffon VII engine).

15 seconds, Service ceiling 25,000 ft. (7.620 m.), Take-off run (wind 31 m.p.h.=50 km.h.) 480 ft. (146 m.). Take-off with eight 4-second rockets at 21,700 lbs.(9,843 kg.) in 31 m.p.h. (50 km.h.) wind 70 yds. (64 m.), Endurance 5.3 hours, Range 1.036 miles (1,667 km.).

THE FAIREY BARRACUDA.

The Barracuda was the first monoplane torpedo-bomber to go into service in the Royal Navy. The original S.24/37 was designed round the Rolls-Royce Exe 24-cylinder X-type engine. Early in the constructional stage the power-plant was changed to the Rolls-Royce Merlin 30, an engine with many entirely different characteristics. The delay this caused was responsible for retarding the initial production programme. The Merlin-engined prototype first flew on December 7, 1940.

The first prototype Barracuda had an unbraced tailplane in-line with the top of the fuselage. During the early trials it was found that when the flaps were in the diving position the disturbed air caused serious tail flutter. To overcome this the tailplane of the second prototype was raised some 4 ft. (1.22 m.) to clear the wake from the flaps and also to clear the folding wings. The first trials with the re-positioned tail-unit were made in July, 1941, and showed that the trouble had been entirely eliminated.

The Barracuda was first used operationally in September, 1941, in raids from H.M.S. *Victorious* on Kirkenes in Northern Norway and on Petsamo in Finland. In 1942 Barracudas took part in sweeps over French ports and in the invasion of Madagascar. The first major action in which Barracuda squadrons took part was in a successful bombing attack on the German battleship *Tirpitz* in Alten Fiord, North Norway, on April 3, 1944. It was in action against the Japanese for the first time in an attack on enemy installations at Sabang, in the island of of Sumatra, on April 19, 1944.

The following are the principal versions of the Barracuda :—

Barracuda I. Rolls-Royce Merlin 30 engine driving a Rotol three-blade constant-speed airscrew.

Barracuda II. Rolls Royce-Merlin 32 engine driving a Rotol four-blade constant-speed airscrew.

Barracuda III. Similar to the Mk. II but fitted with ASV 10 radar equipment in a bulge under the fuselage.

Barracuda V. Rolls-Royce Griffon VII engine driving a Rotol four-blade airscrew. Improved version of the Mk. II with greater range and increased speed over a much greater height range. Wings of 4 ft. (1.22 m.) greater span and increased internal fuel capacity. Larger rudder and dorsal fin. Generally-strengthened structure to give greater margin of safety in pull-outs from dives. Radar equipment carried in quickly removable unit in one wing. Crew consists of pilot and observer/telegraphist, the latter carrying out duties of navigator and radio-operator. Armament consists of one forward-firing .5-in. (12.7 m/m.) machine-gun. No rear armament. The Barracuda V prototype, in effect the first production aircraft of this type, first flew in June, 1945. The Barracuda was withdrawn from production in 1946.

Type.—Three-seat Naval Torpedo-Bomber.

Wings.—Shoulder-wing cantilever monoplane. Centre-section stubs built integrally with the fuselage. Outer sections have constant taper and rounded tips. Two-spar all-metal structure with diaphragm ribs, intercostal stringers and a stressed-skin covering. Hydraulically-operated Youngman flaps suspended below and staggered back from trailing-edge of wing, may be partly lowered for take-off, fully lowered for landing, and raised to negative angle for retarding speed in a dive. Flaps have metal frames and Alclad sheet covering. Metal-framed ailerons covered with fabric. Wings fold about vertical joint pins at the rear spars, the trailing-edges of the outer wings, complete with flaps, folding up and onto the upper surfaces to give clearance at the fuselage for folding. Retractable wing-holds under the wing tips. Wing area 367 sq. ft. (34.1 sq. m.).

Fuselage.—Oval all-metal structure with flush-riveted smooth metal skin. Engine-mounting, framework of the pilot's cockpit and rear bay of the fuselage are of steel tube. Remainder is a metal monocoque.

Tail Unit.—Braced monoplane type. Tailplane mounted near top of fin and braced to the fuselage by a single strut on each side. All-metal framework with fin and rudder covered with Alclad sheet and the elevators and rudder with fabric. Trim-tabs in elevators and rudder.

Landing Gear.—Retractable type. Cantilever oleo legs held at top in torsion boxes at ends of horizontal triangular structures which are hinged to the bottom edges of the fuselage. When retracted the horizontal members of each L-unit hinge up to lie in recesses in the sides of the fuselage and the oleo shock-absorber legs and wheels stow away in the leading-edge of the wings ahead of the front spars. Operation by hydraulic jack located across floor of fuselage between landing-gear units. Hydraulic wheel-brakes. Non-retracting tail-wheel. Deck-arrester hook lies flush in the underside of the fuselage ahead of the tail-wheel. Catapult spools.

Power Plant.—One Rolls-Royce Merlin 32 (Mk. II) or Griffon VII (Mk. V) twelve-cylinder Vee liquid-cooled engine driving a Rotol four-blade constant-speed airscrew. Self-sealing fuel tanks in centre section between spars.

Accommodation (Mk. II).—Crew of three in tandem cockpits under a continuous transparent hooding. Pilot ahead of the leading-edge of the wing with sliding cockpit canopy. Observer/navigator and rear gunner/radio operator over centre and trailing-edge of wing respectively, with hinged portions of hooding which can be tipped up to form windshields. Navigator and radio operator have alternative positions within the fuselage, the navigator having bay windows beneath the wings for downward vision.

Accommodation (Mk. V).—Crew of two, pilot and observer/telegraphist, the latter undertaking the duties of navigator and radio-operator.

Armament and Equipment (Mk. II).—Two .303 in. (7.7 m/m.) Vickers K gas-operated machine-guns on Fairey flexible mounting in rear crew position. One 18 in. (45.7 c/m.) torpedo carried externally on crutches under the fuselage. Alternatively three 500 lb. (227 kg.) bombs may be carried under each wing. Depth-charges or sea mines can also be carried. For bombing-up, racks are fitted to the bombs on ground or deck and complete assemblies are hoisted up to the wings where the racks are clipped into position. Dinghy and rescue equipment carried in fuselage.

Armament (Mk. V).—One .5 in. (12.7 m/m.) forward-firing machine-gun. No rear armament. Stores and equipment similar to Mk. II.

Dimensions (Mk. II).—Span 49 ft. 2 in. (15 m.), Width folded 18 ft. 3 in. (5.56 m.), Length 40 ft. 6 in. (12.35 m.), Height 15 ft. 5 in. (4.7 m.).

Dimensions (Mk. V).—Span 53 ft. 2 in. (16.21 m.), Length 40 ft. 3 in. (12.27 m.), Height 15 ft. 3 in. (4.65 m.).

Weight Loaded (Mk. II).—14,500 lbs. (6,583 kg.).

Weight Loaded (Mk. V).—16,423 lbs. (7,456 kg.).

Performance (Mk. II).—Maximum speed 220 m.p.h. (352 km.h.) at 10,000 ft. (3,050 m.), Climb to 5,000 ft. (1,525 m.), 4 min. 48 sec., Range 443 sea miles (802 km.).

Performance (Mk. V).—Maximum speed 244 m.p.h. (390.4 km.h.) at 10,000 ft. (3,050 m.), Climb to 5,000 ft. (1,525 m.) 2 min. 30 sec., Normal range 735 sea miles (1,360 km.) at 159 m.p.h. (254.4 km.h.), Maximum range (with auxiliary tankage) 1,200 sea miles (2,220 km.).

FOLLAND.

FOLLAND AIRCRAFT, LTD.

Head Office and Works: Hamble, Southampton.

Directors: H. P. Folland, M.B.E., F.R.Ae.S., M.I.Ae.E., F.R.S.A., F.I.Ae.S. (Managing), C. L. Hill, E. N. Egan, (Secretary), R. J. Norton, and T. Gilbertson (General Manager).

Chief Engineer and Technical Director: H. E. Preston, F.R.Ae.S.

Chief Designer: B. V. Leak, A.F.R.Ae.S.

This Company was originally formed as British Marine Aircraft Ltd. in February, 1936, primarily to construct the American Sikorsky S-42 flying-boat. In June, 1937, the company was completely re-organized. Mr. H. P. Folland joined the board as managing director, and in December, 1937, the company assumed its present title. Mr. Folland had previously served as Chief Engineer and Designer to the Gloster Aircraft Co. Ltd., and was responsible for a long range of successful single-seat fighters as well as a series of Gloster racing aircraft and Schneider Trophy seaplanes. Mr. Folland took with him to the new company an expert team of technicians who had served under him at Gloster Aircraft.

Facilities at the company's extensive works at Hamble, on Southampton Water, were increased during the late war, and the company was mostly engaged in large-scale sub-contract work. In addition, however, it originated three types of its own design; the Folland 43/37 flying test-bed, particulars of which were included in the last issue of this Annual; the E.28/40 Torpedo-Bomber monoplane with a variable-incidence wing, and the F.19/43 fighter with a 2,500 h.p. Bristol Centaurus XII engine and contra-rotating airscrews. The E.28/40 aircraft was not completed but the prototype was fairly well advanced before the contract was cancelled. The F.19/43 was not proceeded with.

During 1946 the Company was engaged in the manufacture of components for various civil aircraft, including the Vickers Viking, the D.H. Dove and the Bristol 167. The design staff has also been employed in investigating various types of aircraft, including a civil type incorporating new features in safety and a novel design for an amphibian. Approximately 67% of the company's activities during the year were devoted to aircraft work, the remainder to various commercial undertakings.

G.A.L.

GENERAL AIRCRAFT LTD.

Head Office, Works and Aerodrome: The London Air Park, Feltham, Middlesex.

Chairman: Sir Maurice Bonham-Carter, K.C.B., K.C.V.O.

Directors: J. M. Ferguson, F.C.A., H. V. Gort, F.C.I.S., L. Peskin, C. F. Lumb and L. G. Reid (Managing).

Chief Designer: F. F. Crocombe, B.Sc., A.C.G.I., D.I.C., F.R.Ae.S.

General Aircraft Ltd. was formed in 1934 to manufacture civilian aeroplanes, and their first production was the Monospar twin-engined light monoplane. Later developments were the Cygnet and Owlet low-wing monoplanes, and the construction of a special Monospar with a pressurized cabin—the first such aircraft to be produced in this country.

During the War the Company produced two main types; the G.A.L. 48 Hotspur eight-seat military training glider, which was mainly responsible for the training of the glider pilots of the Airborne Forces, and of which 1,000 were built, and the G.A.L. 49 Hamilcar tank-carrying glider. The Hamilcar was initially designed and constructed in 1941-42 and was adapted for a great variety of military loads. It was used on all the major Allied airborne landings. During 1944 its immediate development, the G.A.L. 50 Hamilcar X powered-glider was produced. This version was specifically produced for operation in the Far Eastern theatre and was fitted with two Bristol Mercury 31 radial engines. Both the Hamilcar I and X continue to be used as standard equipment by the Airborne Division.

Parallel with this work, General Aircraft has been interested since 1934 in the development of tail-less aircraft. A research programme involving the construction of four tail-less gliders was undertaken and three of these had been produced at the time of writing. Details of one of these, the G.A.L. 56/01, are given hereafter.

Late in 1943 the Company contracted for sister-firm responsibility in respect of the Sikorsky R-4 and R-5 helicopters, which involved modification, repair and maintenance work for the Royal Navy and Royal Air Force.

The Company was also engaged in large-scale production of components under sub-contract, and in production of the Fairey Firefly two-seat fleet fighter.

As a post-war development, General Aircraft has been entrusted with the prototype design and construction of a large four-engined transport aircraft, the G.A.L. 60, which has equal applications for military and civil purposes. A brief description of this type follows.

THE G.A.L. 60.

The G.A.L. 60 is a projected four-engined Universal Transport aircraft intended for passenger or freight-carrying purposes. It has been specially designed for economic operation on medium-range services, and to have exceptional take-off and landing performance in adverse weather conditions.

The G.A.L. 60 is to be a cantilever high-wing monoplane of all-metal construction powered by four Bristol Hercules 620 fourteen-cylinder sleeve-valve radial air-cooled engines driving four-blade reversible-pitch airscrews. It will have a tricycle landing gear, the main wheels being non-retractable and supported by shock-absorber legs under the inner engine nacelles, and twin nose-wheels retracting into the fuselage. In the freight transport version the entire forward fuselage will provide a cargo space 36 ft. long × 10 ft. wide × 10-15 ft. high (10.97 m. × 3.05 m. × 3.05-4.57 m.) and capacity for 11 tons. The passenger model will be arranged in two decks and will have accommodation for 90 passengers and 7,320 lb. (3,320 kg.) baggage.

Dimensions.—Span 162 ft. 0 in. (49.38 m.), Length 98 ft. 4 in. (28.97 m.), Height overall 31 ft. 0 in. (9.44 m.).

Weights (Designed).—Weight loaded 87,300 lbs. (39,598 kg.), Payload 24,640 lbs. (11,176 kg.).

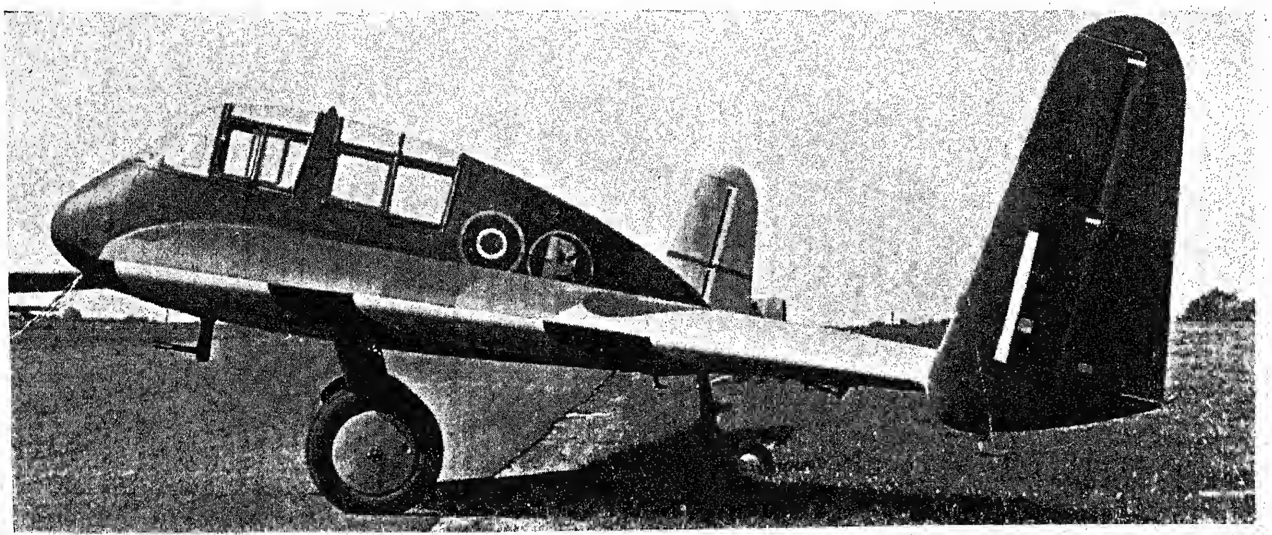
Performance (Estimated).—Economic cruising speed 170 m.p.h. (274 km.h.) at 5,000 ft. (1,525 m.), Landing speed (with flaps) 77 m.p.h. (124 km.h.), Service ceiling 22,000 ft. (6,705 m.), Range 3,400 miles (5,472 km.) at 151 m.p.h. (243 km.h.) at 10,000 ft. (3,050 m.).

THE G.A.L. 56.

The G.A.L. 56 is an experimental tail-less glider which was built as part of an official programme to investigate aerodynamic characteristics of tail-less aircraft. The prototype, designated the G.A.L. 56/01, is the first of four such types and was first towed into the air in November, 1944.

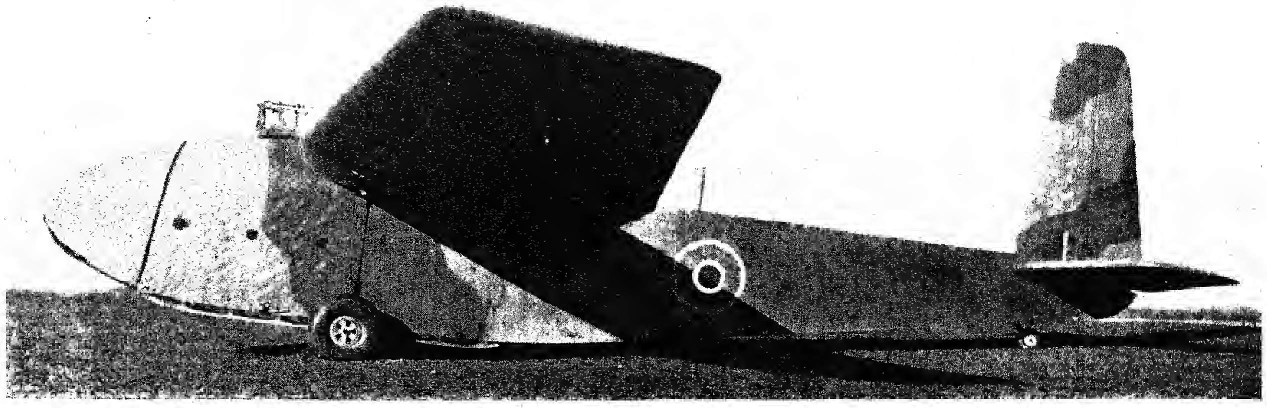
Type.—Two-seat Tail-less Glider for Research Purposes.

Wings.—Cantilever low-wing monoplane. Aerofoil section Modified R.A.F. 34. Wooden structure with stub centre-section integral with fuselage and two sharply swept-back and tapered outer wings. Single box-spar consisting of two laminated booms faced on both



The General Aircraft G.A.L. 56/01 Experimental Tail-less Glider.

***G.A.L.**—continued.*



The General Aircraft Hamilcar Tank or Vehicle-carrying Glider.

sides with ply shear diaphragms. Ply covering of low-quality wood sheets interspersed with sheets of Kraft processed paper. Aspect ratio 5.87; washout 5 degrees; normal dihedral 30 minutes; provision for variable dihedral of 1½-4 degrees. Sweepback at ¼-chord 28.4 degrees; root chord 11 ft. 4 in. (3.45 m.); tip chord 3 ft. 7.58 in. (1.11 m.); nett wing area 317 sq. ft. (29.44 sq. m.); gross wing area 350 sq. ft. (32.5 sq. m.). Longitudinal and lateral control by "elevons," with trim-tab in each. Total elevon area (with tabs) 56 sq. ft. (5.19 sq. m.); tab area (total) 4.4 sq. ft. (0.41 sq. m.). Pneumatically-operated split trailing-edge flaps between elevons and fuselage. Two alternative sets, each of 20% chord, with hinge-lines at 70% and 50% local wing chord. Flap area (each set) 39.6 sq. ft. (3.66 sq. m.). Emergency wing-tip parachutes.

FUSELAGE.—Steel-tube structure with wooden formers and plywood covering. Length of fuselage 15 ft. 5 in. (4.70 m.).

FINS AND RUDDERS.—Cantilever twin fins and rudders mounted as endplates to wing-tips. Spruce structure with plywood covering. Differential control provides outward movement of 33 degrees and inward movement of 4 degrees. Total fin area 22.8 sq. ft. (2.10 sq. m.); total rudder area 15.5 sq. ft. (1.42 sq. m.).

LANDING GEAR.—Fixed two-wheel type. Dowty internally-sprung main wheels carried in rigid legs attached to front face of wing spar. Track 12 ft. 3 in. (3.73 m.). Tail-wheel with anti-shimmy grooved tyre carried on oleo-pneumatic strut.

ACCOMMODATION.—Two enclosed cockpits in tandem for pilot and observer. Observation equipment in rear of fuselage. Single tow-point in nose.

DIMENSIONS.—Span 45 ft. 4 in. (13.8 m.), Length overall 18 ft. 8 in. (5.69 m.); height 8 ft. 9 in. (2.67 m.).

WEIGHTS AND LOADINGS.—Maximum weight loaded 4,400 lbs. (1,996 kg.), Wing loading 12.57 lbs./sq. ft. (61.3 kg./sq. m.).

PERFORMANCE.—Maximum towing speed 150 m.p.h. (241 km.h.), Maximum diving speed 200 m.p.h. (322 km.h.), Stalling speed 58 m.p.h. (93 km.h.).

THE G.A.L. 49 HAMILCAR.

The Hamilcar was originally designed to Specification S.27/40 to carry the Tetrarch tank or two Universal carriers. Later, however, it was adapted for the carriage of a great variety of military loads, for which its spacious cabin and load capacity of eight tons made it particularly suitable. The Hamilcar was towed by Halifax, Lancaster or Stirling four-engined bombers. The prototype first flew on March 27, 1942.

TYPE.—Military tank or vehicle carrying glider.

WINGS.—High-wing cantilever monoplane. Aerofoil section RAF.34 modified. Aspect ratio 7.3. Centre-section and two tapering outer sections. Structure comprises two box spars with laminated booms and plywood webs, built-up former ribs and a plywood skin covered with fabric. Attachment of outer wings to centre-section by two fore-and-aft pin-joints per spar. Incidence 5½ degrees. Root chord 18 ft. 6 in. (5.64 m.). Tip chord 9 ft. 1½ in. (2.78 m.). Wing area 1,657.5 sq. ft. (154 sq. m.). Dynamically-balanced slotted ailerons have single-spar, former ribs, plywood leading-edge and fabric covering. Trim-tab in starboard aileron. Pneumatically-operated slotted flaps between ailerons and fuselage Flaps are all wood with single box spar, diaphragm ribs and plywood skin.

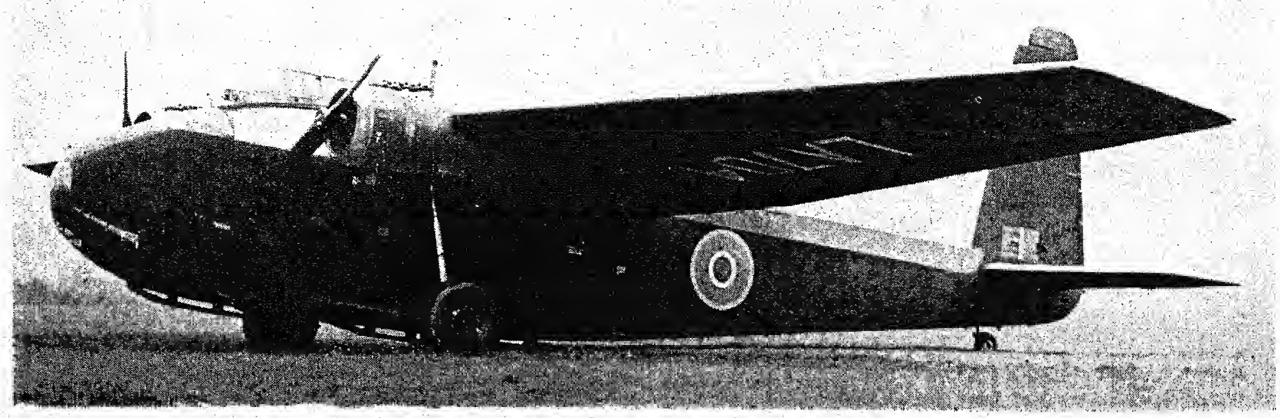
FUSELAGE.—Rectangular all-wood semi-monocoque structure in two main sections which may be separated for transport purposes. Structure consists of a series of vertical square frames, four corner longerons and a fabric-covered plywood skin supported by intercostal stringers. Two massive frames reinforced by high-tensile steel gusset plates at their bottom corners transmit lift loads from centre-section spars to the fuselage and a keel beam between the suspension frames acts as the main load anchorage. The nose of the fuselage is hinged to open to starboard for loading. In the roof of the forward portion of the fuselage ahead of the rear centre-section spar is the flight compartment well. This is a separate built-up unit supported on three transverse trusses and is completed by a transparent canopy which stands proud of the fuselage decking. The rear fuselage terminates in two heavy frames which support the fin and tailplane and the tail-wheel. Maximum fuselage width 9 ft. 3 in. (2.82 m.).

TAIL UNIT.—Cantilever monoplane type. Fin and tailplane are two-spar structures with a plywood skin. Elevators and rudder are wood-framed and fabric-covered. Trim-tabs in elevators and rudder. Tailplane span 32 ft. 6 in. (9.90 m.).

LANDING GEAR.—Divided type. Each unit consists of two vees hinged to the lower fuselage longerons and a vertical oleo-pneumatic shock-absorber leg hinged to the centre-section front spar. The vees are built up of two stainless steel boxes, the rearmost acting as the axle beam. All anchorages are in the form of universal ball-joints. For loading and unloading the main hold the pressure in the shock-absorber struts is released to permit the aircraft to sink under its own weight on to ash skids mounted on rubber blocks under the lower longerons. Differentially-operated wheel-brakes. Alternative landing-gear without shock-absorbers may be jettisoned in flight when skid landings have to be made. Fully-castering tail-wheel.

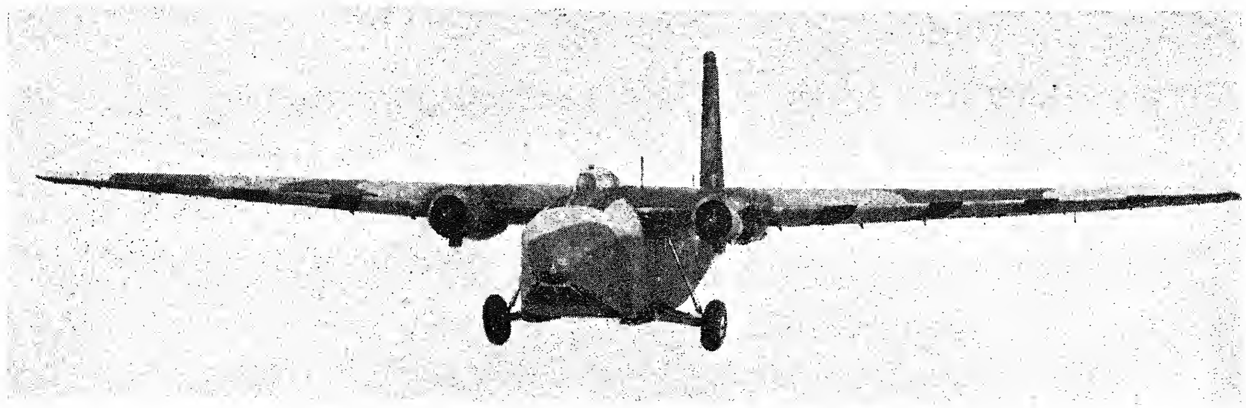
ACCOMMODATION.—Flight compartment in upper portion of forward fuselage seating two in tandem with dual controls. Bullet-proof windshield and armour behind second pilot. Access to compartment by ladder on inner starboard side of fuselage, through hatch in roof and along walkway on top of centre-section. Main freight compartment 25 ft. 6 in. (7.78 m.) long, 8 ft. (2.44 m.) wide and 7.5 ft. (2.3 m.) high. A variety of military equipment can by carried up to a maximum of 17,500 lbs. (7,950 kg.). Nose of fuselage hinges to starboard for loading. Cable-operated push-rod assembly opens the nose either manually, or automatically as a vehicle drives forward. Vehicle rails on bottom of fuselage can be adjusted to suit tracks of different vehicles. Central load anchorage point on keel beam. Exhaust extractors in sides of fuselage to permit vehicles to start up their engines before landing.

DIMENSIONS.—Span 110 ft. (33.5 m.), Length 68 ft. (20.7 m.), Height (tail down) 20 ft. 3 in. (6.2 m.).



The General Aircraft Hamilcar X Powered Glider (two Bristol Mercury 31 engines).

***G.A.L.**—continued.*



The General Aircraft Hamilcar X Powered Glider (two Bristol Mercury 31 engines).

Weights and Loadings.—Weight empty 18,400 lbs. (8,350 kg.). Military load 17,600 lbs. (7,980 kg.), Weight loaded 36,000 lbs. (16,330 kg.), Wing loading 22.37 lbs./sq. ft. (109.2 kg./sq. m.).

Performance (at sea level).—Maximum towing speed 150 m.p.h. (240 km.h.), Maximum diving speed 187 m.p.h. (300 km.h.), Stalling speed 65 m.p.h. (105 km.h.).

THE G.A.L. 58 HAMILCAR X.

The Hamilcar X is in effect the Hamilcar I glider strengthened at appropriate points for the installation of two 965 h.p. Bristol Mercury 31 engines. It was produced to comply to Specification X.4/44, and the prototype first flew in February, 1945. The external appearance excepting for the mounting of these engines and a minor difference in the application of the telescopic oleo-pneumatic struts of the main undercarriage is exactly the same as the ordinary glider version. The track is increased to 20 ft. (6.1 m.). The span, length, height and cubic capacity of the cabin are identical.

The square-section fuselage comprises an unobstructed hold of internal dimensions sufficient to accommodate a large variety of heavy military freight from a 7½-ton tank or two Bren gun carriers to a 17-pounder anti-tank gun with its towing vehicle, and engineering equipment loads such as bulldozers, scrapers and tractors and Bailey bridge equipment.

Single-point towing is used in the Hamilcar X as against bi-furcated towing in the case of the Hamilcar I.

The Hamilcar X is capable of solo flight as a normal twin-engined aircraft up to a weight of 32,500 lbs. (14,742 kg.), the disposable load in this condition being 6,990 lbs. (3,171 kg.). In solo flight at full load after release from the tug aircraft the rate of descent is 150 ft./min. (46 m./min.).

Dimensions.—As Hamilcar I.

Weights.—Weight empty 25,510 lbs. (11,571 kg.), Military load 17,500 lbs. (7,977 kg.), Normal loaded weight 45,500 lbs. (20,636 kg.), Maximum overloaded weight 47,000 lbs. (21,319 kg.).

Performance (as a solo aircraft at 32,500 lbs. = 14,742 kg. loaded weight).—Maximum speed 145 m.p.h. (233 km.h.), Cruising speed 112 m.p.h. (179 km.h.), Ceiling 9,000 ft. (2,745 m.).

Performance (in towed flight at full load using a Halifax III as tug).—Towing speed 150 m.p.h. (240 km.h.), Take-off distance to 50 ft. (15 m.) 1,040-1,950 yds. (952-1,800 m.) according to all-up weight of tug dictated by range requirements. Rate of climb at sea level 435-730 ft./min. (133-224 m./min.) according to tug weight.

GLOSTER.

GLOSTER AIRCRAFT CO. LTD.

Head Office, Works and Aerodrome: Hucclecote, Glos.

Chairman: Sir Frank Spencer Spriggs, Hon. F.R.Ae.S.

Directors: R. V. Atkinson, H. Burroughes, F.R.Ae.S. and T. O. M. Sopwith, C.B.E., F.R.Ae.S.

General Manager: P. G. Crabbe.

Chief Designer: W. G. Carter, M.B.E., F.R.Ae.S.

Secretary: E. W. Shambrook.

The Gloster Aircraft Co., Ltd., which now forms part of the Hawker Siddeley Group, was formed in 1917 and since then has specialised mainly in the production of light aircraft. The many successful types developed and built by the company, including the Grebe, Gauntlet and Gladiator, have been responsible for the steady expansion of the works organization.

During the war the Gloster company was engaged in production of the Hawker Hurricane, and later was responsible for the major proportion of the Typhoon programme.

To the Gloster company belongs the distin tion of being the first aircraft manufacturer in either Great Britain or the United States to design, build and fly an aircraft fitted with jet propulsion. Following on the successful development of the Whittle jet engine, the Air Ministry placed an order with the company in 1939 for the design and construction of an aeroplane to be fitted with this power-unit. In May, 1941, the Gloster E.28/39 jet-propelled monoplane made its first flight piloted by the late Flt.-Lt. P. E. G. Sayer, who was then the company's chief test-pilot.

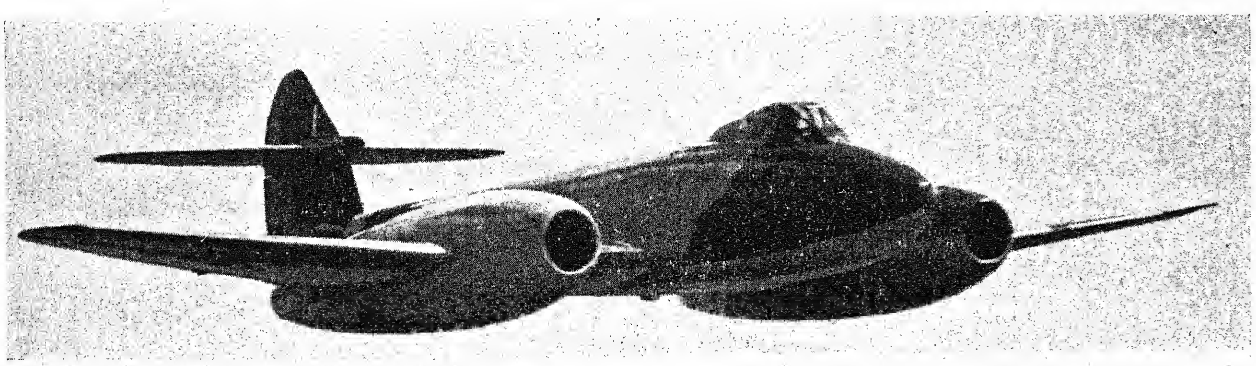
From the experience gained in the design, construction and flight testing of the E.28/39 the Gloster company designed and put into production the Meteor single-seat twin-jet fighter monoplane, which was the only Allied jet-propelled aircraft to go into operational use during the war. The Meteor is fitted with two Rolls-Royce jet units.

Over and above its normal production commitments, the Company is engaged in a very extensive development and research programme on entirely new projects.

THE GLOSTER METEOR.

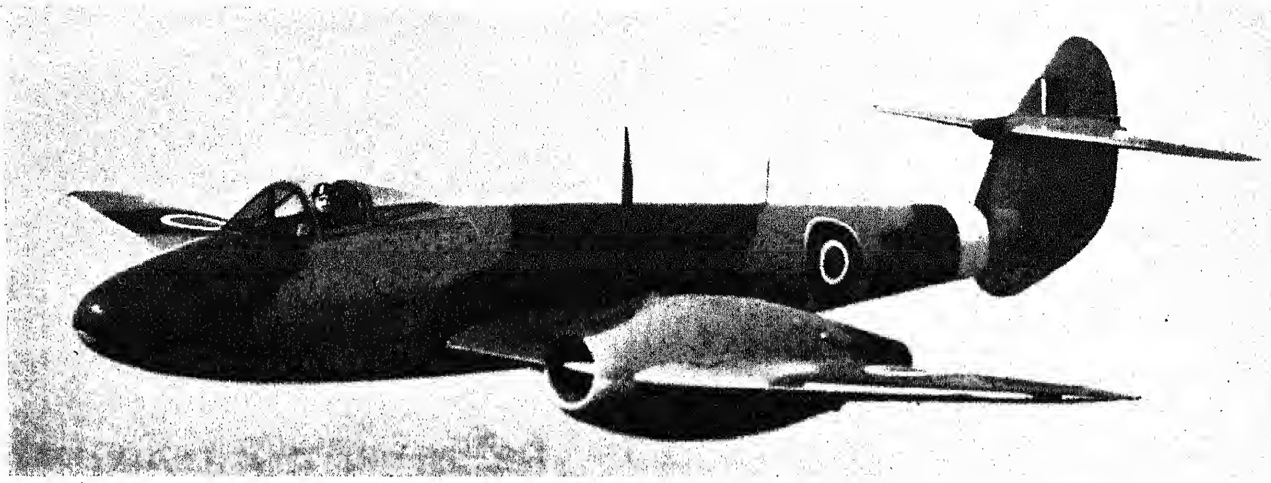
The Meteor was designed to meet Specification F.9/40, the first such British specification to be issued for a combat aircraft to be fitted with jet propulsion. The F.9/40 airframe was used to test several different types of British gas turbines including the Rover-built Power Jets W2B, the parent design of the Rolls-Royce Welland with which the Meteor I was fitted; the Metropolitan Vickers F.2/1, the first British axial flow unit to fly (November 13, 1943); the Halford H.1, the predecessor to the D.H. Goblin; and the Rolls-Royce Trent, the first airscrew gas-turbine to fly. Actually the Halford-engined F.9/40 was the first version of the Meteor to fly (March 5, 1943) as the W2B engines installed in another F.9/40 in July, 1942, were not ready for flying until June, 1943.

The Meteor was the only Allied jet-propelled aeroplane to go into operational service in the War 1939-45.



The Gloster Meteor IV (two Rolls-Royce Derwent V turbo-jets) which established a World's Speed Record of 616 m.p.h. (991 km.h,) in September, 1946.

***GLOSTER**—continued.*



The Gloster Meteor III Single-seat Fighter (two Rolls-Royce Derwent I engines).

On November 7, 1945, a Gloster Meteor IV piloted by Group Capt. H. J. Wilson, A.F.C., R.A.F., broke the World's Speed Record over a 3 km. speed course at Herne Bay, Kent, with a speed of 606 m.p.h. (969.6 km.h.), the average of four runs over the course, two in each direction. A second Meteor IV piloted by Mr. Eric Greenwood, chief test pilot of the Gloster Aircraft Co., Ltd., put up a speed of 603 m.p.h. (964.8 km.h.) over the same course on the same day.

The two Meteor IV aircraft used for these flights were standard production models from which all operational equipment, radio mast, external fuel tank, etc. had been removed, gun ports faired over and a high polish finish applied. They were fitted with two Rolls-Royce Derwent V jet engines which were developing only about 88 to 90 per cent. of their maximum output during the record flights.

On September 7, 1946, Group Captain E. M. Donaldson, D.S.O., A.F.C., flying a Meteor IV fitted with Derwent V turbo-jets, set up a new World's Speed Record with a speed of 616 m.p.h. (991 km.h.), A second Meteor flown by Sqdn. Ldr. W. A. Waterton, A.F.C., attained an average speed of 614 m.p.h. (988 km.h.).

Tropical and winterisation trials were undertaken during 1945-46 on standard Meteor aircraft at Khartoum, in the Sudan, and at Edmonton, Alberta, Canada. The latter trials were conducted in the winter months under extremely arduous conditions with ground temperatures as low as 30° below Zero.

The following are the principal versions of the Meteor :—

Meteor I. Two Rolls-Royce Welland jet units. Canopy type cockpit hood. Not fitted with operational air-brakes. Only a small number built.

Meteor III. Two Rolls-Royce Derwent I jet units, although a few of the earlier Mk. IIIs were fitted with the Welland. The first quantity production version. Sliding cockpit hood. Few later Mk. IIIs fitted with the lengthened engine nacelles standardised on the Mk. IV. Fitted with long-range fuselage drop tank.

Meteor IV. Two Rolls-Royce Derwent V jet-units. Current standard service model. Long engine nacelles, drop tanks and fittings for bombs, rocket projectiles and photographic-reconnaissance equipment. Provision for cockpit pressurisation. Also fitted with wings of reduced span (37 ft. 2 in. = 11.3 m.) which improve rate of roll.

Meteor V. Development of Mk. IV. Underslung engine nacelles. Some to be equipped as radio-controlled pilotless targets.

TYPE.—Single-seat twin-jet Fighter.

WINGS.—Low-wing cantilever monoplane. Wide centre-section integral with the fuselage centre portion includes the two jet nacelles and landing-gear units. Outer wing sections have increased taper and rounded tips. Upper and lower air-brakes and flaps on centre-section, internally mass-balanced ailerons with automatic balance tabs on outer sections. All-metal stressed-skin wing and aileron structure. Wing area 374 sq. ft. (34 sq. m.).

FUSELAGE.—Oval section all-metal stressed-skin structure. In four sections comprising the nose, the front fuselage with nose wheel, the centre fuselage embodying the wing centre-section with the two power nacelles and main landing-gear units, and the rear fuselage complete with tail portion.

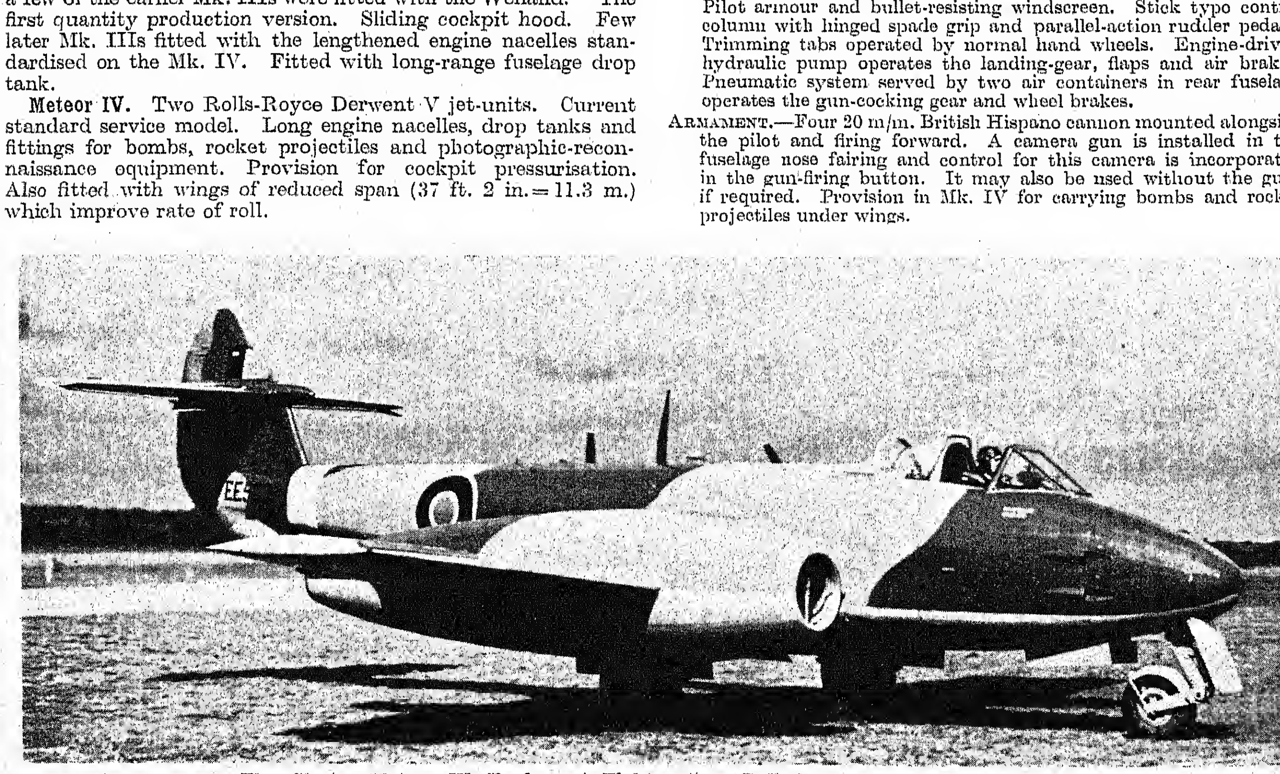
TAIL UNIT.—Cantilever monoplane type. Tailplane mounted near top of fin splitting the rudder in two parts. Trimming tabs are fitted to each elevator and to lower portion of rudder.

LANDING GEAR.—Retractable tricycle type. Dowty levered-suspension springing. Main wheels raised inwardly, the legs being compressed on retraction to lessen space occupied in the wings. Nose wheel raised backwards, the wheel itself being housed between the rudder pedals in the front fuselage. In addition to the normal electrical indicators, there is a mechanical down lock indicator for the nose wheel unit showing just forward of the windscreen. Hydraulic retraction with emergency hand-pump. Pneumatic brakes on main wheels.

POWER PLANT.—Two Rolls-Royce Derwent V turbo-jet units mounted just inboard of the extremities of the centre-section. Self-sealing fuel tanks in inner wings between fuselage and nacelles. Total internal fuel capacity 325 Imp. gallons (1,478 litres). External drop tank faired to underside of fuselage. Capacity 180 Imp. gallons (819 litres). Oil system for each engine self-contained.

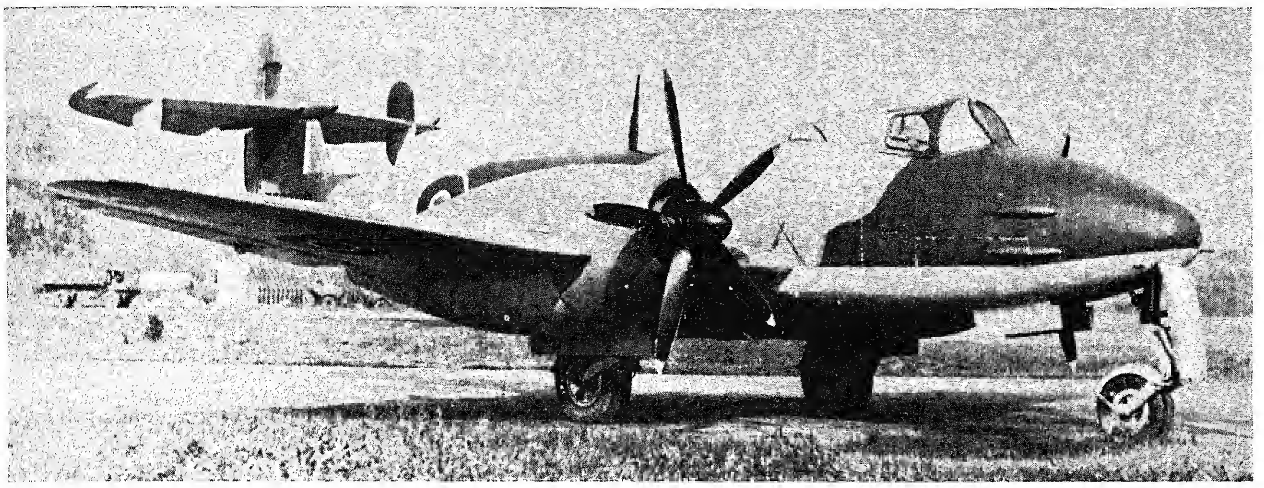
ACCOMMODATION.—Pilot's cockpit forward of the leading-edge of the wings. Sliding and jettisonable blister-type cockpit canopy. Pilot armour and bullet-resisting windscreen. Stick type control column with hinged spade grip and parallel-action rudder pedals. Trimming tabs operated by normal hand wheels. Engine-driven hydraulic pump operates the landing-gear, flaps and air brakes. Pneumatic system served by two air containers in rear fuselage operates the gun-cocking gear and wheel brakes.

ARMAMENT.—Four 20 m/m. British Hispano cannon mounted alongside the pilot and firing forward. A camera gun is installed in the fuselage nose fairing and control for this camera is incorporated in the gun-firing button. It may also be used without the guns if required. Provision in Mk. IV for carrying bombs and rocket projectiles under wings.



The Gloster Meteor IV Single-seat Fighter (two Rolls-Royce Derwent V engines).

GLOSTER—*continued.*



A Gloster Meteor fitted experimentally with Rolls-Royce Trent gas-turbines driving five-blade airscrews.

DIMENSIONS.—Span 43 ft. (13.1 m.), Span (clipped): 37 ft. 2 in. (11.3 m.), Length 41 ft. 3 in. (12.6 m.), Height 13 ft. (3.96 m.), Wing area 374 sq. ft. (34 sq. m.).

WEIGHTS (Meteor I).—Weight empty 8,140 lbs. (3,695 kg.), Weight loaded 11,800 lbs. (5,357 kg.), Wing loading 31.5 lbs./sq. ft. (153.7 kg./sq. m.).

WEIGHTS (Meteor III).—Weight empty 8,800 lbs. (3,995 kg.), Weight loaded 12,500 lbs. (5,675 kg.), Wing loading 33.4 lbs./sq. ft. (163 kg./sq. m.).

WEIGHTS (Meteor IV).—Weight empty 10,050 lbs. (4,562 kg.), Weight loaded 14,500 lbs. (6,583 kg.), Wing loading 38.7 lbs./sq. ft. (189 kg./sq. m.).

PERFORMANCE (Meteor I).—Maximum speed at sea level 385 m.p.h. (619 km.h.), Speed at 30,000 ft. (9,145 m.) 410 m.p.h. (669 km.h.), Initial rate of climb 2,155 ft./min. (657 m./min.), Ceiling 40,000 ft. (12,190 m.).

PERFORMANCE (Meteor III).—Maximum speed at sea level 460 m.p.h. (740 km.h.), Maximum speed at 30,000 ft. (9,145 m.) 475 m.p.h. (764 km.h.), Cruising speed at sea level 425 m.p.h. (685 km.h.). Cruising speed at 30,000 ft. (9,145 m.) 440 m.p.h. (708 km.h.), Initial rate of climb 4,000 ft./min. (1,220 m./min.), Ceiling 44,000 ft. (13,410 m.).

PERFORMANCE (Standard R.A.F. Meteor IV).—Maximum speed at sea level 585 m.p.h. (941 km.h.), Maximum speed at 30,000 ft. (9,145 m.) 550 m.p.h. (858 km.h.), Cruising speed at sea level 540 m.p.h. (869 km.h.), Cruising speed at 30,000 ft. (9,145 m.) 530 m.p.h. (852 km.h.), Stalling speed with flaps and landing gear down 100 m.p.h. (161 km.h.), Landing speed 120 m.p.h. (195 km.h.), Initial rate of climb 7,900 ft./min. (2,409 m./min.), Ceiling 54,000 ft. (16,460 m.).

HANDLEY PAGE.

HANDLEY PAGE, LTD.

HEAD OFFICE AND WORKS: CRICKLEWOOD, LONDON, N.W.2.

AERODROME: COLNEY STREET, RADLETT, HERTFORDSHIRE.

Directors: S. R. Worley, F.C.A. (Chairman), Sir Frederick Handley Page, C.B.E. (Managing Director), D. F. Sutherland, C.A., and J. Hamilton.

Chief Designer: R. S. Stafford, F.R.Ae.S.

Secretary: E. Walmsley, F.C.I.S.

The firm of Handley Page, Ltd., has been associated with flying in all its aspects for the past thirty-eight years. It thus possesses the proud distinction of being the first limited company incorporated in Great Britain for the purpose of manufacturing aircraft.

The Company has specialised in the design of heavy aircraft for military and civilian operations. They produced the World's first large bomber, the 0/400, during the 1914-18 War and in 1918 the V.1500 four-engined biplane, which was intended to bomb Berlin from bases in England. Other bombers delivered to the Royal Air Force between the Wars were the Hyderabad, Hinaidi, Heyford, Harrow and Hampden, and in 1941 the Halifax four-engined bomber. The Hampden and the Halifax were widely used on operations during the late War.

Production of the Halifax ceased in November, 1946, more than 6,000 having been produced since 1939. Throughout the War they were in the van of the British air offensive, twenty-six versions of the original aircraft being produced for the many different combat roles. Almost 76,000 sorties were flown by Halifaxes on bombing operations, and nearly a quarter of a million tons of bombs were dropped on enemy targets. Bomber Command had no less than seventy-six Halifax squadrons in action at the time of its peak strength. In order to achieve this great output a manufacturing group of companies was established with the Handley Page organization as the parent concern. More than 40% of all the heavy bombers produced for the R.A.F. between 1940 and 1944 were Halifaxes. These aircraft continue in service with the R.A.F. and with the French Air Force, and a number have been converted for commercial freight work.

The latest products of the Company are the Hermes four-engined pressurized passenger and freight transport, which is projected in a number of different forms; and the Hastings, the multi-purpose non-pressurized military counterpart of the Hastings. Twenty-five Hermes IV and two prototype Hermes V have been ordered by the Ministry of Supply. The Hastings is in production for the R.A.F.

For the period before the Hermes airliners are available in quantity the Halton civil conversion of the Halifax has been produced. A fleet of these aircraft is in service with British Overseas Airways Corporation.

An interesting experiment by Handley Page is the H.P. 75 Manx, which was designed and constructed for flight research on problems connected with tail-less aircraft. Intensive flying tests have provided Handley Page designers with comprehensive data in this sphere.

THE HANDLEY PAGE H.P. 68 HASTINGS.

The Hastings is a military transport version of the Hermes airliner which is in production for the Royal Air Force. As the two types are complementary it is more convenient to combine their descriptions. For further details of the Hastings see under Hermes.

The Handley Page H.P. 68 Hastings Military Transport (four Bristol Hercules 101 engines). *(Charles Brown).*

HANDLEY PAGE—*continued.*

THE HANDLEY PAGE HERMES.

The Hermes is a four-engined pressurized airliner which has also been adopted for military transport duties under the name of Hastings. Structurally the two types are generally alike. The first prototype Hermes was flown for the first time on December 2, 1945.

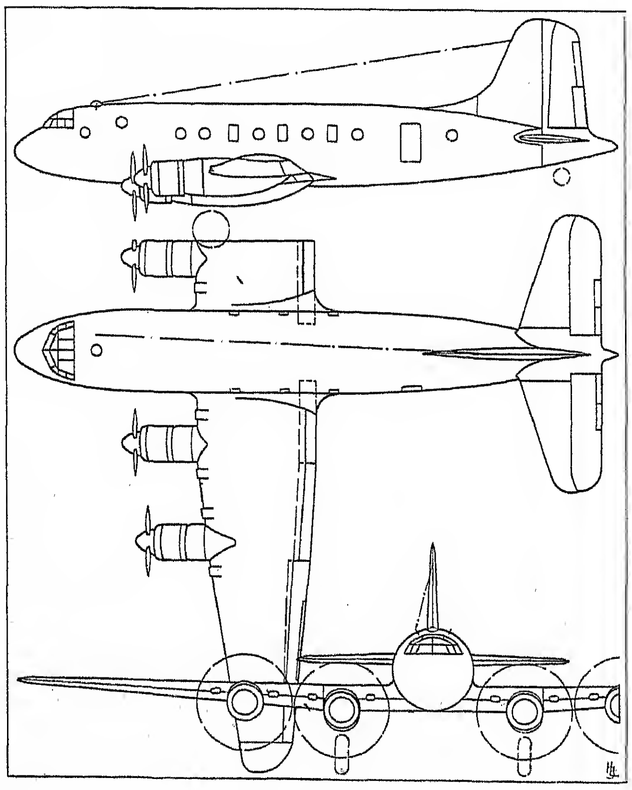
The second prototype was completed as a Hastings, and this version has since been put into production for the Royal Air Force. The original commercial version, however, is giving way to newer models with lengthened fuselage and tricycle landing gear, which at the time of writing were under development. The various models of the Hermes/Hastings are as under :—

H.P. 67 Hermes I. First prototype. Intended as a post-war commercial air-liner with pressurized cabin and accommodation for a maximum of 50 passengers. Not proceeded with.

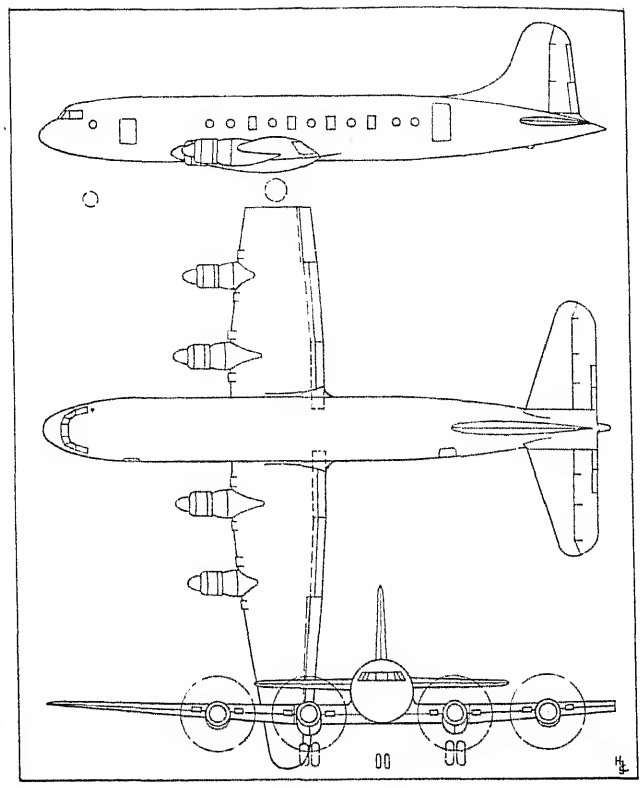
H.P. 68 Hastings C. Mk. I. As Hermes I, but equipped for military troop and freight-transport duties, and conforms to Specification C.3/44. Non-pressurized accommodation. In production for the R.A.F. Prototype first flew May 3, 1946.

H.P. 68 Hermes I Civil Freighter. As Hermes I, but intended solely for freight-carrying work. 1,670 h.p. Hercules 101 engines.

H.P. 74 Hermes II. Modified version of Hermes I with longer fuselage to accommodate greater number of passengers. Estimated cruising speed 300 m.p.h. (482 km.h.), and range 4,080 miles (6,566 km.). Prototype approaching completion at time of writing, and scheduled to fly early in 1947. Series production not intended.



The Handley Page Hermes I.



The Handley Page Hermes IV.

H.P. 79 Hermes III. Projected version, since abandoned, to have had the larger fuselage of the Hermes II and to be powered by Bristol Theseus gas-turbines driving tractor airscrews. Replaced by Hermes V.

H.P. 81 Hermes IV. Projected civilian version, fully pressurized, to replace Mk. II. 1,950 h.p. Bristol Hercules 763 engines. Longer fuselage, tricycle landing gear, and larger tail surfaces. Accommodation for up to 63 passengers. Maximum fuel tankage 3,100 Imp. gallons (14,102 litres). For estimated weights and performance figures see specification.

H.P. 82 Hermes V. Similar to Hermes IV but to be powered by four Bristol Theseus gas-turbines each developing the equivalent of 2,290 h.p. and driving tractor airscrews. To replace Hermes III. Estimated weights and performance figures given in specification.

All versions employ the same constructional methods, and apart from minor differences the wings are identical. The following description, except where indicated, refers specifically to the Hastings C. Mk. I, which at the time of writing was the only version to have flown, and is consequently applicable also to the Hermes I Civil Freighter.

TYPE.—Four-engined Airliner or Military Transport.

WINGS.—Cantilever low-wing monoplane. Aerofoil section NACA 23021 at root tapering to NACA 23007 at tip. All-metal two-spar structure consisting of centre-section carrying inner engine nacelles, two intermediate sections carrying outer engine nacelles, and two outer wings with detachable tips. Centre-section front spar consists of extruded channel booms braced by heavy-gauge diagonals of box construction ; rear spar has T-section extruded booms with web-plate of extruded angle vertical members. Plate chordwise

The Handley Page Hastings Transport (four Bristol Hercules 101 engines).—(*Charles Brown*).

***HANDLEY PAGE**—continued.*

The Handley Page H.P. 68 Hastings Transport (four Bristol Hercules 101 engines).—(*Charles Brown*).

ribs, reinforced at landing-gear and engine mounting points. Intermediate wing sections have front spar of T-section extruded booms with web plate, and angle-section rear spar. Both spars in outer wings have extruded angle booms and plate webs. Pressed light-alloy chordwise ribs, with reinforced tubular-braced alloy ribs at engine mounting points, spanwise double angle section stringers and stressed alloy skin. Incidence 2 degrees; dihedral, nil on top surface centre-section; 1 degree 25 minutes on intermediate sections, and 2 degrees 5 minutes on top rear spar on outer wings; leading-edge sweepback 9 degrees 31 minutes on outer sections; 6 degrees 22 minutes on intermediate sections. Root chord 16 ft. (4.88 m.); tip chord 5 ft. 10 in. (1.78 m.); gross wing area 1,408 sq. ft. (130.8 sq. m.). Mass-balanced Frise-type metal ailerons on outer wings, built up of D-spar, light alloy ribs and steel sheet covering. Spring-tab and trim-tab in each. Total aileron area 98.3 sq. ft. (9.13 sq. m.); aileron movement 28 degrees up, 17 degrees down. Spring-tab area 5.7 sq. ft. (0.43 sq. m.); spring-tab movement 16 degrees up, 16 degrees down; trim-tab area 1.68 sq. ft. (0.156 sq. m.); trim-tab movement 15 degrees up, 7.5 degrees down. All-metal hydraulically-operated trailing-edge flaps in two sections each side between ailerons and fuselage. Single-spar structure with pressed light alloy ribs and stressed alloy skin. Inner flap area 50.2 sq. ft. (4.66 sq. m.); outer flap area 58.4 sq. ft. (5.42 sq. m.).

FUSELAGE.—All-metal structure of circular cross-section built in three main sections with rolled alloy Z-section transverse frames, stabilized by intercostal plate members; top-hat section longitudinal stringers and sheet alloy panels riveted to stringer flanges. Floor structure of transverse beams and channel-section intercostals with covering of Plymax panels. Maximum external diameter 11 ft. (3.35 m.).

TAIL UNIT.—All-metal cantilever monoplane type. Tailplane, constructed in two sections with detachable tips, has single main spar of extruded angle booms and light alloy web plate riveted on. D-section nose, pressed chordwise ribs and stressed sheet metal covering. Fin similarly constructed, with single swept-back spar and dorsal extension. Mass-balanced rudder and elevators consist of light-alloy D-spar rivetod to plate web, pressed sheet ribs and metal skin. Spring-tab and trim-tab in each movable surface. Gross tailplane and elevator area 325 sq. ft. (30.19 sq. m.); total elevator area 126.7 sq. ft. (11.77 sq. m.); elevator movement 25 degrees up, 20 degrees down. Tab area (each elevator) 4.28 sq. ft. (0.34 sq. m.); tab movement 6 degrees up, 14 degrees down. Rudder area 64.5 sq. ft. (6 sq. m.); movement 25 degrees each way; trim-tab area 4.26 sq. ft. (0.395 sq. m.); spring-tab area 7.74 sq. ft. (0.718 sq. m.); tab movement 15 degrees each way.

LANDING GEAR.—Retractable two-wheel type. Each main wheel carried on Messier unit composed of an arch casting with two oleo-pneumatic shock-absorber struts to which are attached radius-rods and operating jacks. Main units retract rearwards into inner engine nacelles and are enclosed by twin-doors. Hydraulic operation. Track 24 ft. 8 in. (7.52 m.). Tail-wheel carried in fork on shock-absorber leg retracts rearwards into fuselage and is fully enclosed. Dunlop wheels and tyres.

POWER PLANT.—Four Bristol Hercules 101 fourteen-cylinder two-row radial sleeve-valve air-cooled engines each rated at 1,675 h.p. for take-off, mounted on steel-tube bearers and enclosed in long-chord cowling with controllable trailing-edge cooling gills. Rotol cooling fan in front of engines. D.H. four-blade constant-speed full-feathering, reversible-pitch metal airscrews, 13 ft. (3.96 m.) diameter. Riveted sheet alloy fuel tanks in wings, seven each side of fuselage, with total capacity of 2,563 Imp. gallons (11,657 litres). Tanks secured by straps and removable through upper surface of wing. Four oil-tanks, each of 28 Imp. gallons (127 litres) capacity, two in centre-section and two in leading-edge between engines. Gallay oil-coolers.

ACCOMMODATION.—Flight compartment provides accommodation for pilot (on port) and co-pilot side-by-side with dual controls; radio-operator, navigator and flight engineer. Windscreen assembly of light alloy castings bolted together, with flat Triplex panels in front and clear-vision side panels. Crew entrance door 5 ft. 6 in. high × 3 ft. wide (1.68 m. × 0.91 m.). In Hastings C. Mk. I and Hermes I Civil Freighter entire fuselage space from crew compartment to rear bulkhead is available for freight. Maximum internal diameter 10 ft. 4 in. (3.15 m.); maximum height 7 ft. 3 in (2.21 m.). Freight-loading door 9 ft. 4 in. wide × 5 ft. 9 in. high (2.84 m. × 1.75 m.) at rear on port side. Reinforced floor allows heavy vehicles to be carried, and vehicles can be driven in *via* a ramp. Fully-pressurized accommodation on civil version. Cabin pressure 6.5 lbs./sq. in. (0.457 kg./sq. c/m.). Main cabin of the Hermes II, IV and V accommodates a maximum of 63 passengers for short-range flights; 52 for medium-range flights and 36-40 in a luxury version providing night accommodation for 18-20. Three toilet compartments, one forward and two aft; galley, complete with refrigerators, etc., at rear of crew compartment; a compartment which can be equipped as a promenade, lounge or bar, and two baggage compartments under floor. Eight escape hatches.

EQUIPMENT.—T.K.S. de-icing equipment.

DIMENSIONS.—Span 113 ft. (34.44 m.), Length (Hastings C. Mk. I and Hermes I Civil Freighter) 82 ft. 2 in. (25.04 m.), Length (Hermes IV and V) 95 ft. 6 in. (29.11 m.), Height (Hastings C. Mk. I and Hermes I Civil freighter, tail down) 22 ft. 6 in. (6.86 m.), Height (Hermes IV and V—over rudder, approximate), 28 ft. 6 in. (8.70 m.).

WEIGHTS AND LOADINGS (Hermes I Civil Freighter).—Weight empty (equipped) 52,600 lbs. (23,839 kg.), Maximum payload 21,200 lbs. (9,616 kg.), Maximum loaded weight 75,000 lbs. (34,018 kg.), Maximum landing weight 71,500 lbs. (32,432 kg.), Wing loading 53.2 lbs./sq. ft. (259.7 kg./sq. m.), Power loading 11.2 lbs./h.p. (5.07 kg./h.p.).

WEIGHTS AND LOADINGS (Hermes IV—designed).—Weight empty (equipped) 54,500 lbs. (24,721 kg.), Maximum payload 17,000 lbs. (7,711 kg.), Maximum loaded weight 82,000 lbs. (37,194 kg.), Maximum landing weight 75,000 lbs. (34,018 kg.), Wing loading 55.8 lbs./sq. ft. (272.4 kg./sq. m.), Power loading 12.2 lbs./h.p. (5.52 kg./h.p.).

WEIGHTS AND LOADINGS (Hermes V—designed).—Weight empty (equipped) 50,900 lbs. (23,088 kg.), Maximum payload 17,100 lbs. (7,756 kg.), Maximum loaded weight 84,000 lbs. (38,101 kg.), Maximum landing weight 75,000 lbs. (34,018 kg.), Wing loading 59.6 lbs./sq. ft. (290.97 kg./sq. m.).

PERFORMANCE (Hermes I Civil Freighter).—Maximum speed 355 m.p.h. (571 km.h.) at 22,700 ft. (6,935 m.), Initial rate of climb 990 ft./min. (325 m./min.), Maximum still-air range 3,430 miles (5,520 km.) at 10,000 ft. (3,050 m.), Range (with 16,200 lbs. = 7,348 kg. payload) 2,000 miles (3,219 km.).

PERFORMANCE (Hermes IV—estimated).—Maximum speed 350 m.p.h. (563 km.h.) at 20,000 ft. (6,095 m.), Initial rate of climb 750 ft./min. (229 m./min.), Maximum still-air range 3,510 miles (5,749 km.) at 25,000 ft. (7,620 m.), Range (with 13,000 lbs. = 5,897 kg. payload) 2,000 miles (3,219 km.).

PERFORMANCE (Hermes V—estimated).—Maximum speed 350 m.p.h. (563 km.h.) at 30,000 ft. (9,145 m.), Initial rate of climb 1,925 ft./min. (587 m./min.), Maximum still-air range 3,090 miles (4,973 km.) at 30,000 ft. (9,145 m.), Range (with 14,400 lbs. = 6,532 kg. payload) 1,610 miles (2,591 km.) at 30,000 ft. (9,145 m.).

THE HANDLEY PAGE H.P. 70 HALTON.

The Halton is a civil conversion of the Halifax bomber and has been supplied to British Overseas Airways Corporation for operation on the United Kingdom-Cairo-Karachi and United Kingdom-West Africa routes. It is intended only as an interim aircraft until the Hermes becomes available.

Generally the Halton is the equivalent of the Halifax C. Mk. VIII and is equipped with the large pannier underneath for the carriage of 8,000 lbs. (3,629 kg.) of baggage. All military

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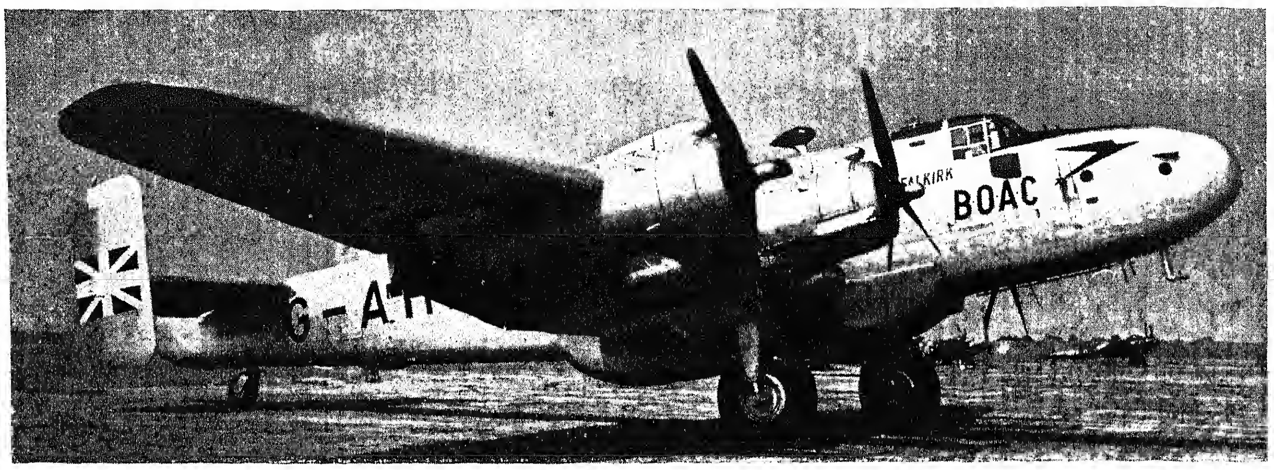


The Handley Page Halton Civil Transport (four Bristol Hercules 100 engines).

equipment and armament has been removed and the interior of the fuselage is completely modified to provide accommodation for ten passengers, five on each side with a central gangway.

The power plant consists of four Bristol Hercules 100 fourteen-cylinder two-row radial sleeve-valve air-cooled engines each developing a maximum output of 1,675 h.p. and driving a D.H. Hydromatic three-blade full-feathering airscrew. The normal fuel capacity is 2,190 Imp. gallons (9,962 litres) and the maximum 2,379 Imp. gallons (10,821 litres).

Conversion work has been done by Short & Harland, Ltd. to Handley Page design. Structurally the Halton remains the same as the Halifax, a full specification of which appeared in the last issue of "All the World's Aircraft."

DIMENSIONS.—Span 103 ft. 8 in. (31.60 m.), Length 73 ft. 7 in. (22.44 m.), Height 20 ft. 8 in. (6.30 m.), Wing area 1,275 sq. ft. (118.4 sq. m.).

WEIGHTS AND LOADINGS.—Maximum weight loaded 65,000 lbs. (29,482 kg.), Maximum payload 10,500 lbs. (4,763 kg.), Maximum landing weight 55,000 lbs. (24,926 kg.), Wing loading 51.1 lbs./sq. ft. (249.3 kg./sq. m.), Power loading 9.7 lbs./h.p. (4.4 kg./h.p.).

PERFORMANCE.—Maximum speed 320 m.p.h. (515 km.h.), Maximum weak mixture cruising speed 270 m.p.h. (434 km.h.) at 15,000 ft. (4,570 m.), Economic cruising speed 210 m.p.h. (338 km.h.) at 15,000 ft. (4,570 m.), Initial rate of climb 740 ft./min. (226 m./min.), Service ceiling 21,000 ft. (6,400 m.), Maximum still-air range (with normal tankage) 2,530 miles (4,071 km.), Maximum still-air range with long-range tanks 3,510 miles (5,649 km.).

THE HANDLEY PAGE H.P. 75 MANX.

The Manx is a two-seat tail-less monoplane produced specially to investigate problems associated with tail-less aircraft. It was ready for flight tests at the outbreak of war, but owing to pressure of work connected with the Halifax production programme it was not until 1944 that the first flight was made.

The nacelle consists of a metal monocoque structure. The wing is mounted in the mid position and is built in three sections, comprising a constant-chord centre-section and two swept-back and tapered outer wings. The outer sections are equipped with "elevons", with split trailing-edge flaps between them and the nacelle, and leading-edge slots. At the extremities of the wings are metal cantilever fins and mass-balanced rudders, and a third fin is fitted at the rear of the nacelle.

Two 140 h.p. D.H. Gipsy Major four-cylinder in-line inverted air-cooled engines are mounted as pusher units on the centre-section and drive two-blade variable-pitch propellers through extensions shafts.

The landing gear is of the tricycle type, each main unit consisting of twin wheels carried on a single shock-absorber leg which retracts forward into the wing, and a spatted non-retractable nose-wheel.

The pilot is accommodated in an enclosed cabin in the front of the nacelle and the observer is situated in another cabin at the rear and faces aft.

DIMENSIONS.—Span 40 ft. (12.19 m.), Length overall 18 ft. (5.50 m.), Wing area 246 sq. ft. (22.8 sq. m.).

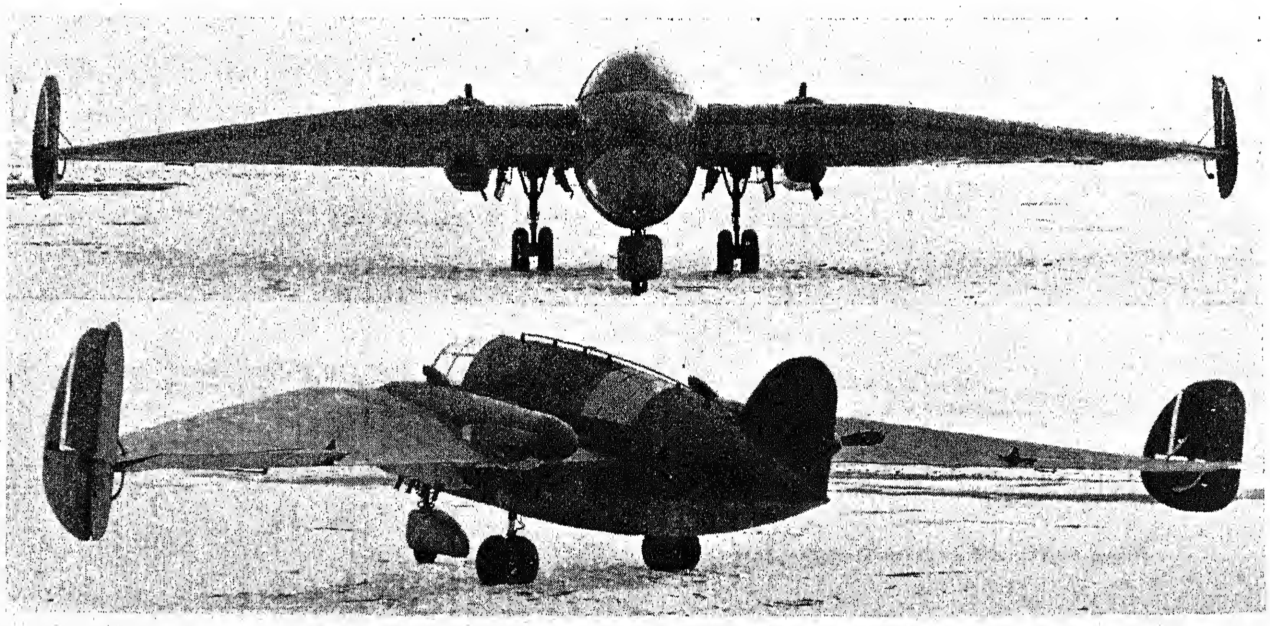
WEIGHT AND LOADINGS.—Weight loaded 4,000 lbs. (1,814 kg.), Wing loading 16.2 lbs./sq. ft. (79.1 kg./sq. m.), Power loading 14.3 lbs./h.p. (6.47 kg./h.p.).

PERFORMANCE (Approximate).—Cruising speed 150 m.p.h. (241 km.h.), Ceiling 10,000 ft. (3,050 m.).

THE HANDLEY PAGE HALIFAX.

The Halifax was originally designed to Specification B.13/36 and the prototype first flew in October, 1939. The first production version was flown in October, 1940, and the first operation by a Halifax was made in the following March. Over 6,000 Halifaxes were built, the last being completed in November, 1946. Altogether twenty-six different versions, equipped with Rolls-Royce Merlin or Bristol Hercules engines, were delivered to the Royal Air Force for various duties. Many still remain in service with the R.A.F., and with the French Air Force, and others have been made available for civilian use.

Details of the Mks. I-VIII were given in the last issue of



Two views of the Handley-Page Manx Experimental tail-less Monoplane. (*Flight Photographs*).

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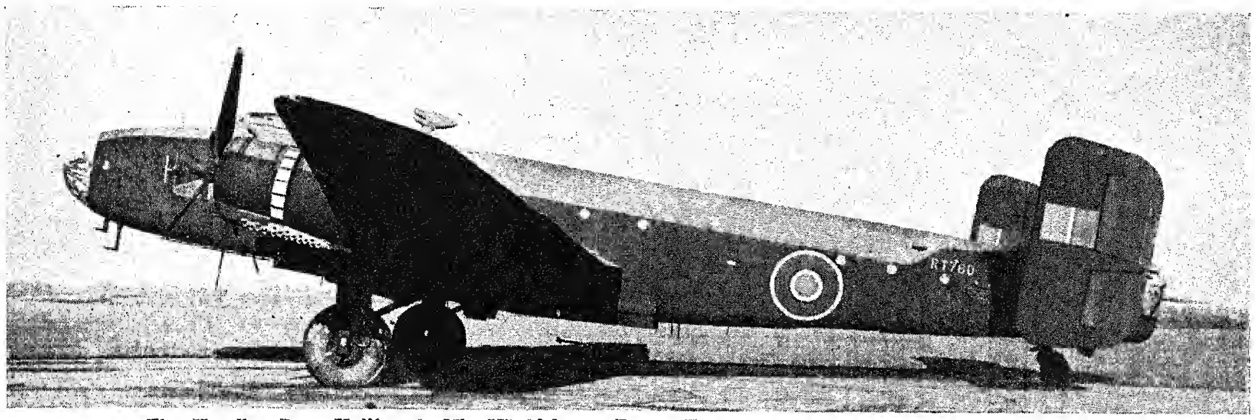


The Handley Page Halifax A. Mk. IX Airborne Forces Transport (four Bristol Hercules XVI engines).

this Annual. The last model, the H.P. 71 A Mk. IX, is a transport version for the Airborne Forces, with a capacity for sixteen parachute-troops. It is powered by 1,675 h.p. Bristol Hercules XVI engines, and armament consists of a Boulton Paul Type D tail-turret mounting twin 0.50 in. (12.7 m/m.) machine-guns. A photograph of the A. Mk. IX appears above.

HAWKER.

HAWKER AIRCRAFT, LTD.

Head Office and Works: Kingston-on-Thames, Surrey.

Established: 1933.

Chairman: Sir Frank Spencer Spriggs, Hon. F.R.Ae.S.

Directors: T. O. M. Sopwith, C.B.E., F.R.A.e.S., P. G. Lucas, G.M., A.F.R.Ae.S. (General Manager), A. N. Spriggs (Works Director) and T. D. M. Robertson (Secretary).

Director and Chief Designer: S. Camm, C.B.E., F.R.Ae.S.

Hawker Aircraft, Ltd., was incorporated in 1933 as successor to the H. G. Hawker Engineering Co., Ltd., which was formed in 1920 as the outcome of the voluntary liquidation of the famous Sopwith concern.

The Hawker company produced during the war as distinguished a line of single-seater fighters as did their Sopwith ancestors during the 1914-1918 war. By a steady process of evolution during the past 25 years, the Hurricane, the Typhoon, and the Tempest were all developed from their early Sopwith counterparts, the Pup, the Camel, the Triplane, the Snipe, the Dolphin and the Salamander. In the intervening years between the two wars, such machines as the Hawker Fury and the Hart became the standard equipment in their classes in the Royal Air Force.

It is not possible to cover in a few lines all that was achieved by Hawker products in the war, but to the credit of each of the three aircraft mentioned above stands an outstanding feat which had a major effect on the course of the war and of history. Firstly, the Hurricane, which was being produced in large numbers at the outbreak of war in September, 1939, played a far greater part than any other aircraft in winning the Battle of Britain in 1940 Then, while the many versions of the versatile Hurricane were being produced in their thousands for service on more than a score of different battle fronts all over the World, the Typhoon was also put into production. The Hawker Typhoon was the first of the 400 m.p.h. fighters, just as the Hurricane was the first fighter to exceed 300 m.p.h., and the Fury the first to exceed 200 m.p.h. Armed with a battery of four rockets under each wing, in addition to their already formidable armament, Typhoons of the 2nd Tactical Air Force effectively smashed the forces of German armour and transport gathered before the final breakthrough at Avranches, which resulted in the complete liberation of France and Belgium. Finally, the Tempest became operational a few months before the Second Battle of London, during which one Tempest Wing alone, commanded by Wing Cdr. R. P. Beamont, D.S.O., D.F.C., accounted for more flying-bombs than did any other type of aircraft engaged in the defence of the capital. The Tempest then proceeded overseas and took part in the final assault through Belgium and Holland to the crossing of the Rhine and the final surrender of Germany.

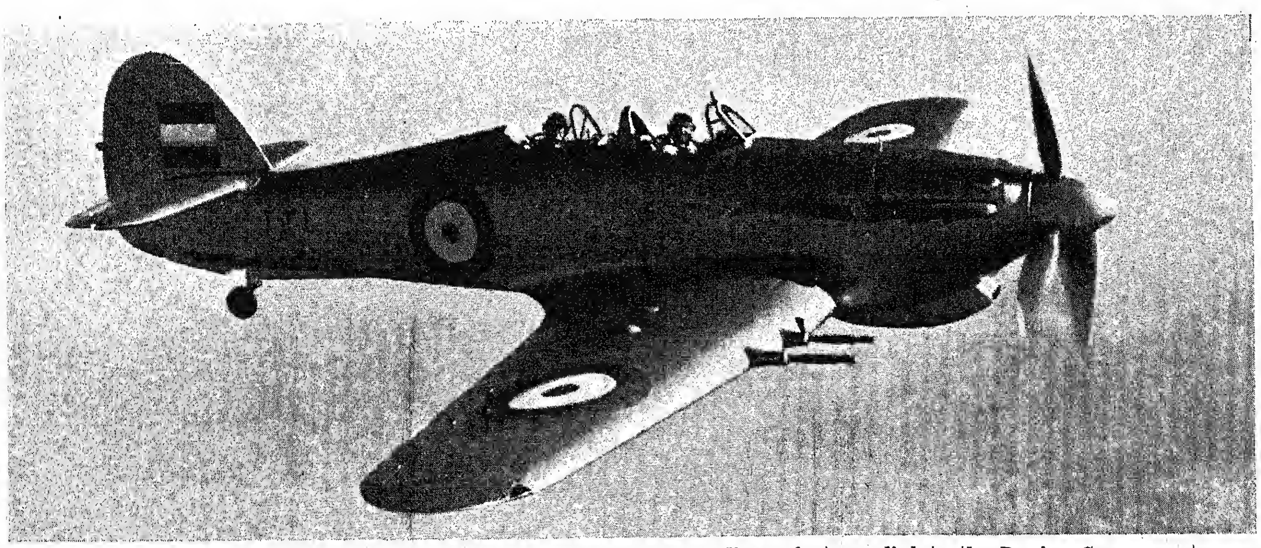
The current types of Hawker aircraft are the Tempest and Fury, both in service in the R.A.F., and the Sea Fury, which is in service in the Royal Navy.

Hawker Aircraft, Ltd. has received several orders from foreign governments. The Netherlands Government have ordered the Sea Fury X and the Iraqi Government the Centaurus-Fury. The latter order is for 30 Fury Fighters and four two-seat trainer versions of the Fury. The Persian Government has acquired a number of Hurricane IIc Fighters and the Hawker company has developed a special two-seat trainer version of the Hurricane for the Persian Air Force. An illustration of this latter type appears below. This now has an enclosed rear cockpit for the instructor.

THE HAWKER FURY.

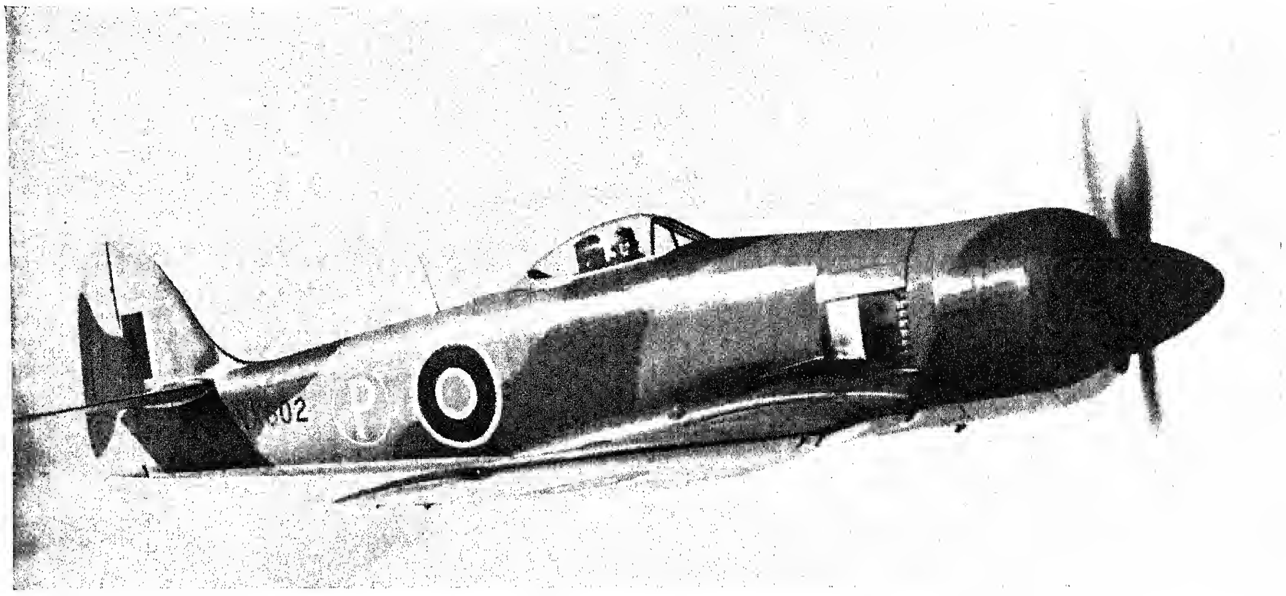
The Fury was designed to conform to Specification F.2/43 and was developed from the Tempest. A light version of the Tempest to Specification F.6/42 had been projected at the end of 1942 but in January, 1943, it was decided to produce a completely new design, which was later named the Fury.

The Fury uses the same high-speed aerofoil section which was specially developed for the Tempest to delay the compressibility effects first encountered with the Tornado and Typhoon. The Fury wing consists of two Tempest outer sections bolted together on the fuselage centre-line instead of being attached



A Hawker Hurricane Two-seat Advanced Trainer (Rolls-Royce Merlin engine) supplied to the Persian Government.

***HAWKER**—continued.*



The first prototype Hawker Fury Single-seat Fighter (Bristol Centaurus XII engine).

to the sides of the fuselage as on the Tempest. The monocoque fuselage and tail-unit are completely new structures.

The Fury has appeared in three main prototype forms, apart from the Sea Fury which is described later. The first prototype was powered with a Bristol Centaurus XII engine driving a Rotol four-blade airscrew, and made its first flight on September 2, 1944. The 2,400 h.p. Centaurus XV engine was later installed.

The second prototype was fitted with a Rolls-Royce Griffon 81 liquid-cooled engine driving Rotol three-blade contra-rotating airscrews. This aircraft first flew on November 27, 1944.

The Fury I is powered with a Napier Sabre VII (N.S.93/SM) liquid-cooled engine driving a Rotol five-blade airscrew. The first flight of the Sabre-engined prototype was made in June, 1946.

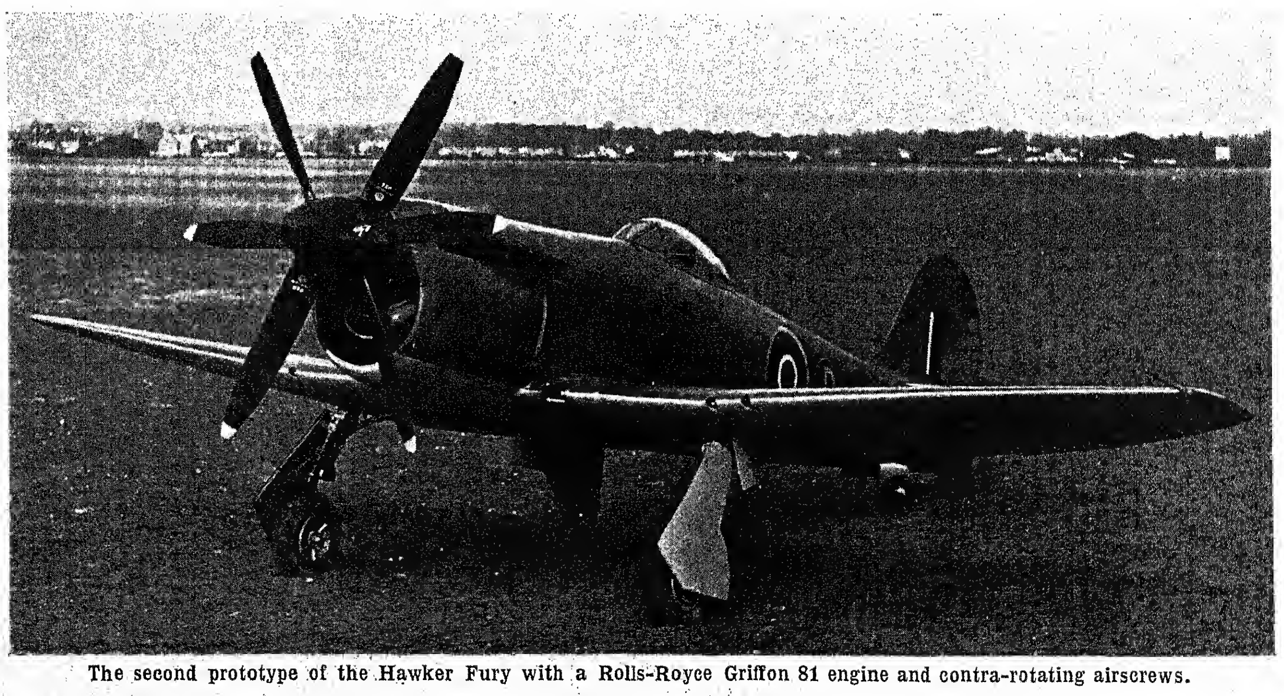
The description below refers to the Fury I with Napier Sabre engine. Details of the Centaurus-engined Fury follow the specification of the Fury I.

TYPE.—Single-seat Fighter or Photographic Reconnaissance monoplane.

WINGS.—All-metal cantilever low-wing monoplane. Hawker H.14/14/37.5 aerofoil section at roots, tapering to H.14/10/37.5 at tips. Two-spar structure built in two sections bolted and riveted together on fuselage centre-line and attached to fuselage at four pick-up points. Inner portions of wings to points of attachment of landing-gear flat, outer portions set at $5\frac{1}{2}°$ dihedral. Spars have extruded section booms and plate webs, inner portions as far as change in dihedral being composed of two L-section extrusions riveted together. Rear spar swept forward from root to gun-bay, thereafter both spars converge slightly. Spar joints at centre-line and at change of dihedral of high-tensile steel shackle straps through-bolted to booms and with butt-straps to webs. Sheet metal diaphragm ribs with nose, interspar and tail sections, longitudinal Z-section stringers and stressed skin covering. Incidence $2\frac{1}{2}$ degrees; root chord 8 ft. $10\frac{3}{4}$ in. (2.72 m.); mean chord 7 ft. $4\frac{3}{4}$ in. (2.24 m.); tip chord 3 ft. $6\frac{1}{2}$ in. (1.08 m.); gross wing area 284.5 sq. ft. (26.43 sq. m.); aspect ratio 5.18. All-metal modified Frise-type mass-balanced ailerons have light alloy channel-section spars with built-up D-nose, light sheet metal ribs and pre-tensioned duralumin skin covering riveted to spars and ribs. Inset trim-tab and Hawker patent spring-tab in each aileron. Total spring-tab area 1.41 sq. ft. (0.13 sq. m.). Total aileron area 24.57 sq. ft. (2.28 sq. m.); aileron movement $15\frac{1}{2}°$ up; 18° down. Hydraulically operated split trailing-edge flaps between ailerons and fuselage in two sections each side. Flap span 18 ft. $10\frac{3}{4}$ in. (5.76 m.); flap area (total) 31.4 sq. ft. (2.92 sq. m.).

FUSELAGE.—All-metal structure in four main sections bolted together, comprising engine mounting; monocoque centre-fuselage to aft of wing trailing-edge; monocoque rear fuselage to leading-edge of fin, and monocoque tail-end with integral fin. Monocoque structure consists of four main longerons with transverse frames and bulkheads, longitudinal top-hat section stringers and riveted stressed metal skin. Heavy frames at wing-spar attachments. Frames in rear fuselage of Z-section with half and full top-hat section stringers.

TAIL UNIT.—All-metal cantilever structure. One-piece tailplane bolted to fuselage. Fin integral with fuselage tail-end. Mass balanced rudder with spring-tab. Aerodynamically and statically-balanced elevators on set-back shrouded hinges, with controllable trim-tab in each. Pre-stretched sheet metal covering over all



The second prototype of the Hawker Fury with a Rolls-Royce Griffon 81 engine and contra-rotating airscrews.

HAWKER*—continued.*

surfaces. Tailplane incidence 1½°, Tailplane span 14 ft. 0 in. (4.26 m.), Tailplane area 34.4 sq. ft. (3.19 sq. m.), Elevator area (both, aft of hinge) 13.62 sq. ft. (1.26 sq. m.), Total elevator area 16.8 sq. ft. (1.56 sq. m.), Elevator movement 23½° up, 11½° down, Elevator trim-tab area (both) 1.29 sq. ft. (0.12 sq. m.), Rudder area 13.8 sq. ft. (1.28 sq. m.), Spring-tab area 0.97 sq. ft. (.09 sq. m.), Rudder movement 27° each way, Fin area 13.5 sq. ft. (1.25 sq. m.).

LANDING GEAR.—Retractable two-wheel type, consisting of two Dowty levered-suspension oleo-pneumatic shock-absorber legs hinged to front spar just inboard of break and retracting inwards behind rear spar. Hydraulic operation. Fairing plates attached to legs and hydraulically-operated doors under fuselage enclose undercarriage in retracted position. Track 12 ft. 0 in. (3.66 m.). Tail-wheel carried in fork on Dowty oil-compression shock-absorber leg retracts forward into fuselage and is enclosed by twin-doors. Dunlop tyres and Dunlop pneumatically-operated differential brakes on main wheels.

POWER PLANT.—One Napier Sabre VII (N.S.93/SM) twenty-four-cylinder H-type liquid-cooled sleeve-valve engine developing 3,000 h.p. for take-off, a maximum output of 3,055 h.p. at 3,850 r.p.m. at 2,250 ft. (685 m.) in M.S. gear, 2,820 h.p. at 3,850 r.p.m. at 12,500 ft. (3,810 m.) with 17¼ lbs./sq. in. (1.21 kg./sq. c/m.) boost for periods up to 5 minutes, and a maximum continuous weak-mixture cruising output of 1,730 h.p. at 3,250 r.p.m. at 8,500 ft. (2,590 m.) or 1,600 h.p. at 17,000 ft. (5,185 m.) with 7 lbs./sq. in. (.49 kg./sq. c/m.) boost. Engine mounting consists of composite light alloy beam on each side of engine, machined channel extrusions being used for top and bottom booms with web plates on both sides, the outer plates forming part of the engine cowling. Large-diameter tubular steel members tie the beams to the fuselage top longeron attachments. Engine feet mounted on box-section transversal light alloy beams, with journal-type flexible rubber bush mountings in front and solid fittings at rear. Rotol five-blade constant-speed metal airscrew 13 ft. 3 in. (4.0 m.) diameter. Fuel carried in one fuselage tank (94 Imp. gallons=427 litres) and two wing tanks (28 Imp. gallons = 127 litres each). Total internal capacity 150 Imp. gallons (681 litres) all in Marston-Mareng flexible self-sealing tanks and all feeding to main fuselage tank. Two long-range drop-tanks (45 Imp. gallons=205 litres or 90 Imp. gallons=409 litres each) may be carried under wings. Self-contained and fully-automatic methanol water injection system with tank (30 Imp. gallons=136 litres) in fuselage. Oil capacity 14 Imp. gallons (64 litres) with 4 Imp. gallons (18 litre) air-space in tank behind engine bulkhead. Oil cooling and carburettor intakes in bottom of engine cowling. Coolant radiators in wing leading-edge. Cooling mixture 70% distilled water and 30% ethylene glycol. Coffman starter.

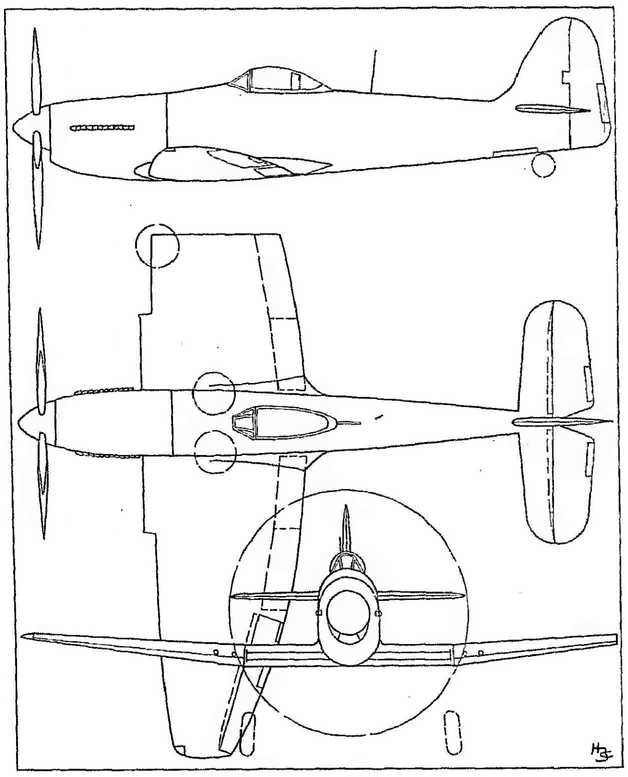
ACCOMMODATION.—Pilot's cockpit over wing with one-piece blown Perspex canopy which slides for access and can be jettisoned. Fixed bullet-proof windscreen. Double-armoured bulkhead behind pilot with ⅝ in. (1.7 c/m.) slab for head and neck protection.

ARMAMENT.—Four 20 m/m. British Hispano Mk. V cannon mounted two in each wing outboard of break and airscrew disc, and can be fired altogether or in pairs. Access doors in upper and lower surfaces aft of rear spar. Magazines in wings have total of 580 rounds. Access doors to magazines in upper surface. Gyro gun-sight. Racks below wings for two 500 lb. (227 kg.) or 1,000 lb. (454 kg.) bombs, twelve 3 in. (7.62 c/m.) or 5 in. (12.7 c/m.) rocket projectiles with 60 lb. (27 kg.) heads, or four Triplox rocket projectiles with 180 lb. (82 kg.) heads. Racks for L.S. carriers with eight 8½ lb. (3.85 kg.) practice bombs.

EQUIPMENT.—V.H.F. and I.F.F. and Homing Beacon radio installations. Engine-driven electric generator. Camera-gun in port wing can be operated separately or in conjunction with guns. Smoke-screen installations can be carried under wings. P.R. version carries two F.24 cameras (one vertical and one oblique) in fuselage.

DIMENSIONS.—Span 38 ft. 4¾ in. (11.69 m.), Length 34 ft. 8 in. (10.56 m.).

WEIGHTS AND LOADINGS.—Weight empty 8,365 lbs. (3,794 kg.), Equipment 2,039 lbs. (925 kg.), Pilot and parachute 200 lbs. (91 kg.), Fuel and oil (normal) 1,516 lbs. (687 kg.), Normal weight loaded 12,120 lbs. (5,497 kg.), Wing loading 42.6 lbs./sq. ft. 208 kg./sq. m.), Power loading at take-off 4 lbs./h.p. (1.81 kg./h.p.).



The Hawker Fury I Fighter.

PERFORMANCE.—Maximum speed 475 m.p.h. (764 km.h.) between 16,000 ft. (4,880 m.) and 22,000 ft. (6,705 m.), Speed at 29,000 ft. (8,840 m.) 450 m.p.h. (724 km.h.), Initial rate of climb (combat rating) 5,400 ft./min. (1,646 m./min.), Climb at 20,000 ft. (6,095 m.) 3,400 ft./min. (1,035 m./min.), Climb (at combat rating) to 10,000 ft. (3,050 m.) 2 minutes, Climb to 20,000 ft. (6,095 m.) 4½ minutes, climb to 30,000 ft. (9,145 m.) 8 minutes, Ceiling 42,000 ft. (12,800 m.), Radius of action (estimated) at maximum economic cruising speed of 210 m.p.h. (332 km.h.) with maximum fuel and with 15 minutes combat allowance 560 miles (901 km.) at 30,000 ft. (9,145 m.), Maximum range of P.R. version 1,825 miles (2,937 km.).

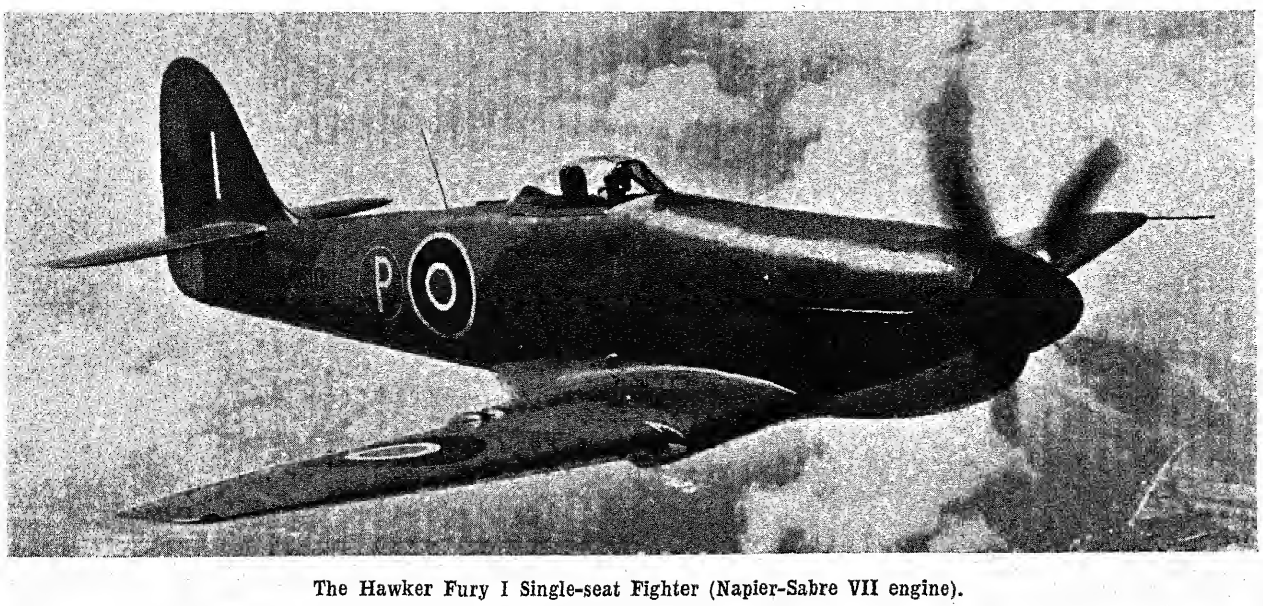
THE HAWKER CENTAURUS-FURY.

The Centaurus-powered Fury differs from the Mk. I with the Sabre engine in the following respects.

WINGS.—Structure as Mk. I. Wing area 280 sq. ft. (26.05 sq. m.), Mean chord 7 ft. 3½ in. (2.3 m.), Aspect ratio 5.26.

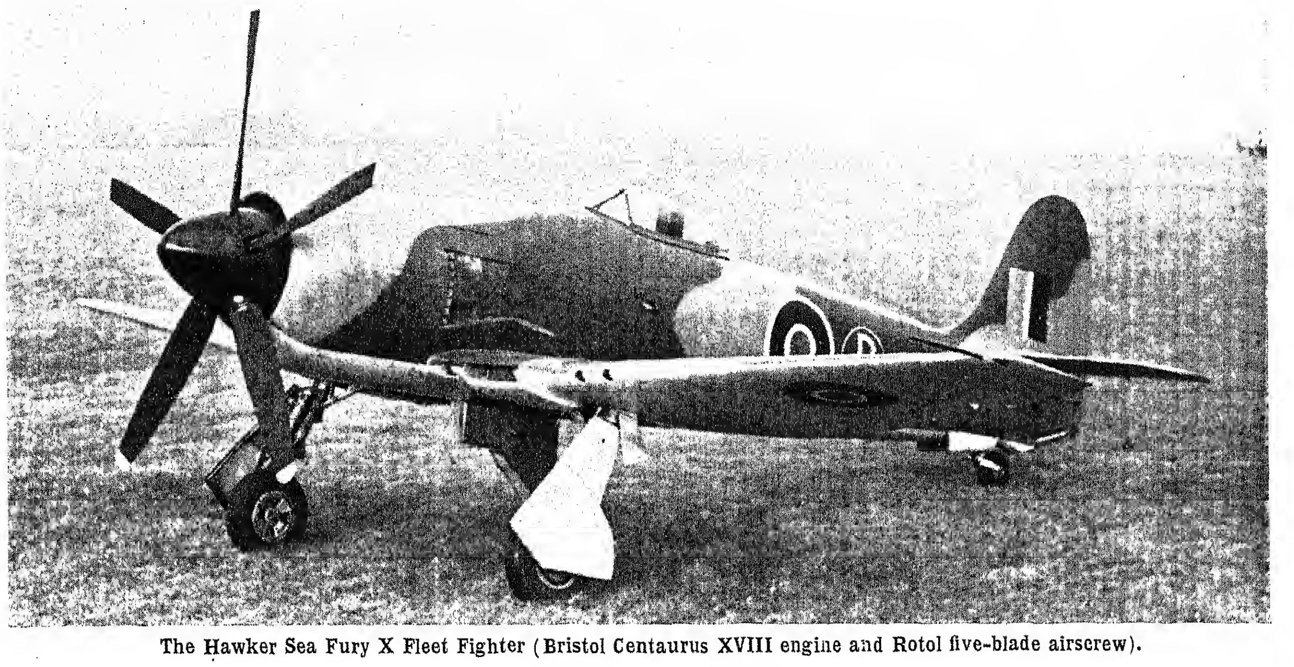
TAIL UNIT.—Structure as Mk. I. Rudder area 12.9 sq. ft. (1.20 sq. m.), Spring-tab area 0.97 sq. ft. (.09 sq. m.), Rudder movement 21° port, 21° starboard. Fin area 11.7 sq. ft. (1.09 sq. m.).

POWER PLANT.—One Bristol Centaurus XV eighteen-cylinder two-row sleeve-valve radial air-cooled engine developing 2,300 h.p. for take-off, a maximum output of 2,400 h.p. at 2,700 r.p.m. at 5,500 ft. (1,675 m.) in M.S. gear, 2,130 h.p. at 20,000 ft. (6,095 m.) with 8½ lbs./sq. in. (0.6 kg./sq. c/m.) boost for periods up to 5 minutes, and a



The Hawker Fury I Single-seat Fighter (Napier-Sabre VII engine).

HAWKER—*continued.*



The Hawker Sea Fury X Fleet Fighter (Bristol Centaurus XVIII engine and Rotol five-blade airscrew).

maximum continuous weak-mixture cruising output of 1,600 h.p. at 2,400 r.p.m. at 12,000 ft. (3,660 m.), or 1,450 h.p. at 24,000 ft. (7,315 m.) with 2 lbs./sq. in. (0.14 kg./sq.c/m.) boost. Engine is rubber-mounted on steel-tube bearer structure attached to fuselage at four points by machined steel forgings. Rotol four-blade constant-speed metal airscrew 12 ft. 9 in. (3.88 m.) diameter, gear ratio .40. Fuel capacity 94 Imp. gallons (427 litres) in main fuselage tank 30 Imp. gallons (136 litres) in auxiliary fuselage tank, 56 Imp. gallons (127 litres) in two inter-spar wing tanks, and 90 Imp. gallons (409 litres) in starboard wing leading-edge tank. Total internal capacity 200 Imp. gallons (909 litres). Two 45 Imp. gallon (204 litre) or 90 Imp. gallon (409 litre) drop-tank may be carried under wings. Oil tank of (14.5 Imp. gallons = 66 litres) behind engine bulkhead. Oil cooler intake in port wing leading-edge. Air intakes in leading-edge wing roots. Coffman starter.

Dimensions.—Span 38 ft. 4¾ in. (11.69 m.), Length 34 ft. 7 in. (10.55 m.).

Weights and Loadings.—Weight empty 7,795 lbs. (3,536 kg.), Equipment 2,094 lbs. (950 kg.), Pilot and parachute 200 lbs. (91 kg.), Fuel and oil (normal) 1,586 lbs. (719 kg.), Weight loaded 11,675 lbs. (5,296 kg.), Wing loading 41.7 lbs./sq. ft. (203.7 kg./sq. m.), Power loading (take-off power) 5 lbs./h.p. (2.27 kg./h.p.).

Performance.—Maximum speed 455 m.p.h. (732 km.h.) at 24,000 ft. (7,315 m.), Speed at 36,000 ft. (10,980 m.) 435 m.p.h. (700 km.h.), Initial rate of climb (combat rating) 4,300 ft./min. (1,270 m./min.), Climb at 25,000 ft. (7,720 m.) 2,600 ft./min. (793 m./min.), Climb (at combat rating) to 10,000 ft. (3,050 m.) 3 minutes, Climb to 20,000 ft. (6,095 m.) 5½ minutes, Ceiling 44,000 ft. (13,410 m.).

THE HAWKER SEA FURY.

The Sea Fury, the Naval counterpart of the Fury previously described, conforms to Specification N.7/43. The first prototype powered with a Centaurus XII engine driving a Rotol five-blade airscrew, was merely a standard land Fury with non-folding wings but fitted with a deck arrester hook. Deck-landing trials were made with this aircraft on H.M.S. *Ocean* in October, 1945.

In its fully navalised form, conforming to Specification 22/43, the Sea Fury X has hydraulically-operated folding wings, provision for accelerated take-off and carries full naval equipment. The wings can be folded with two 1,000 lb. (454 kg.) bombs in position.

The first prototype Sea Fury X was powered by a Centaurus XV engine, but the second prototype and production version has the Centaurus XVIII with an airscrew gear ratio of .444 : 1 for improved take-off.

Like the R.A.F. Fury I, the Sea Fury X is adaptable to a wide range of duties.

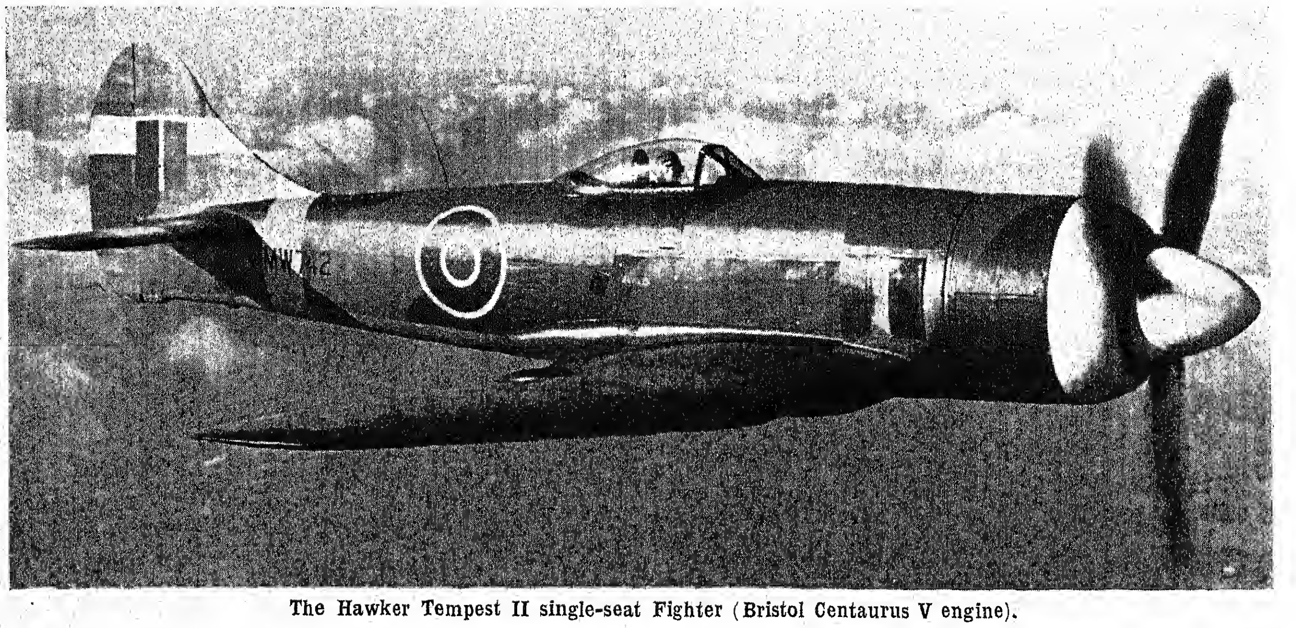
Type.—Single-seat Fleet Fighter.

Wings.—As Fury, except that wing is built in four main sections, the outer sections being arranged to fold upwards. Stress-carrying members at wing-folds of forged high-tensile steel with fork-end and lug-fittings bolted to ends of spars, hinges at top and latches at bottom. Hydraulic folding controlled from cockpit. Wing area as Centaurus-Fury.

Fuselage.—As Fury.

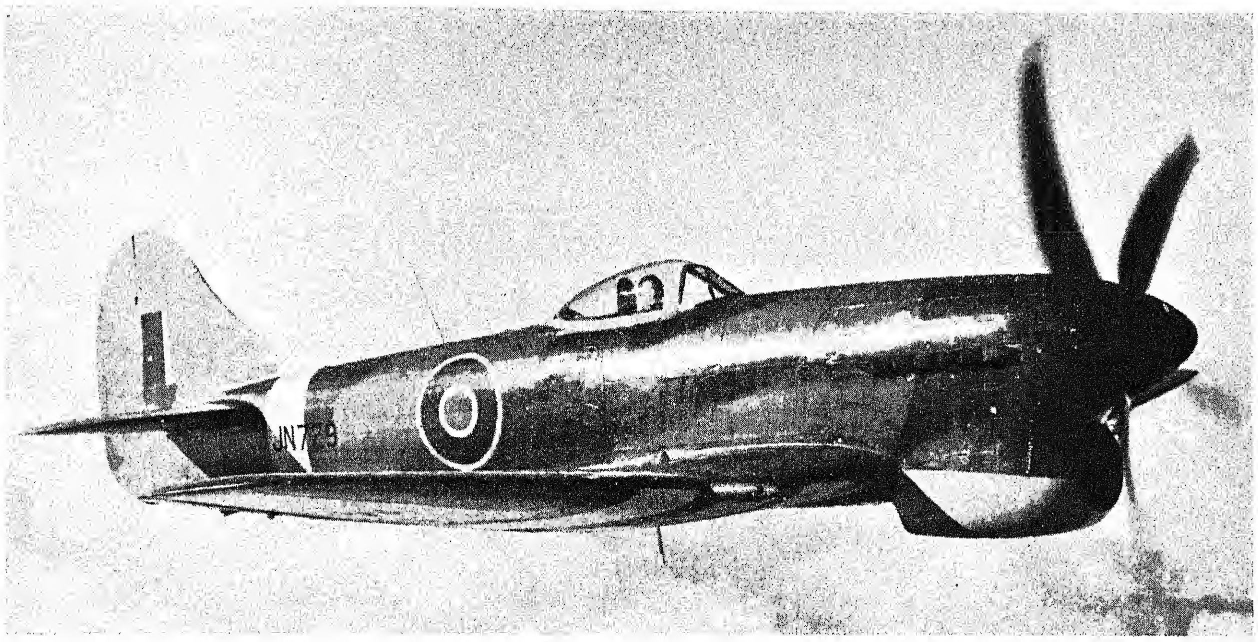
Tail Unit.—Structure as Fury. Bottom of rudder is cut away to allow for sting-type deck arrester hook. Rudder area 13.2 sq. ft. (1.23 sq. m.), Fin area 13.5 sq. ft. (1.25 sq. m.).

Landing Gear.—As Fury, with addition of sting-type deck arrester gear with telescopic hook beneath rudder.



The Hawker Tempest II single-seat Fighter (Bristol Centaurus V engine).

***HAWKER**—continued.*



The Hawker Tempest V Single-seat Fighter (Napier-Sabre IIB engine).

Power Plant.—One Bristol Centaurus XVIII eighteen-cylinder two-row radial sleeve-valve air-cooled engine developing 2,480 h.p. for take-off, a maximum output of 2,560 h.p. at 2,700 r.p.m. at 4,250 ft. (1,295 m.) in M.S. gear, 2,300 h.p. at 17,000 ft. (5,180 m.) with 9½ lbs./sq. in. (0.67 kg./sq. c/m.) boost for periods up to 5 minutes, a maximum continuous weak-mixture cruising output of 1,660 h.p. at 2,400 r.p.m. at 10,750 ft. (3,275 m.) or 1,530 h.p. at 21,250 ft. (6,475 m.) with 2½ lbs./sq. in. (0.17 kg./sq. c/m.) boost. Engine mounting as Centaurus-Fury. Rotol five-blade constant-speed metal airscrew, 12 ft. 9 in. (3.88 m.) diameter, Pitch range 29° 15 minutes to 64° 15 minutes, Gear ratio .444. Fuel and oil capacities as Centaurus-Fury.

Accommodation.—As Fury.

Armament.—As Fury.

Equipment.—As Fury, with dinghy stowage under pilot's seat.

Dimensions.—As Centaurus-Fury, plus, span folded 18 ft. 0 in. (5.48 m.), Height (tail up, wings spread, one airscrew blade vertically down) 12 ft. 3½ in. (3.75 m.), Height (tail up, wings folded) 16 ft. 1 in. (4.90 m.).

Weights and Loadings.—Weight empty 8,045 lbs. (3,650 kg.), Equipment 2,199 lbs. (997 kg.), Pilot and parachute 200 lbs. (91kg.), Fuel and oil (normal) 1,586 lbs. (719 kg.), Weight loaded 12,030 lbs. (5,457 kg.), Wing loading 42.9 lbs./sq. ft. (209 kg./sq. m.), Power loading 4.8 lbs./h.p. (2.17 kg./h.p.).

Performance.—Maximum speed 438 m.p.h. (705 km.h.) at 21,000 ft. (6,400 m.), Speed at 34,000 ft. (10,375 m.) 425 m.p.h. (684 km.h.), Initial rate of climb (combat rating) 4,690 ft./min. (1,429 m./min.), Climb at 20,000 ft. (6,095 m.) 2,600 ft./min. (792 m./min.), Climb (at combat rating) to 10,000 ft. (3,050 m.) 2¼ minutes, Climb to 20,000 ft. (6,095 m.) 5 minutes, Ceiling 43,500 ft. (13,260 m.), Radius of action (estimated) at maximum economic cruising speed with maximum fuel and with 15 minutes combat allowance, 760 miles (1,223 km.) at 10,000 ft. (3,050 m.), Deck take-off run at 13,000 lbs. (5,896 kg.) in 31 m.p.h. (50 km.h.) wind, 177 yds. (162 m.).

THE HAWKER TEMPEST.

The Tempest is a progressive development of the Typhoon, the initial design and development of the type being actually undertaken as part of the Typhoon programme. It was in April, 1941, that discussions were opened between the Hawker company and the Ministry of Aircraft Production on the subject of Typhoon development. Proposals for a Typhoon Mk. II included the installation of a Sabre IV engine of higher power and driving a four-blade airscrew, improved view and a cleaned-up tail. Investigation was also to proceed into the possibilities of an improved aerofoil section.

The Hawker proposals, submitted in August, 1941, included the suggestion that the Typhoon Mk. II should have thin elliptical wings of 42 ft. (12.8 m.) span and 300 sq. ft. (27.9 sq. m.) area and with a 15% thickness/chord ratio at the root and 10% at the tip. The introduction of a new thin-section wing made it necessary to reduce the amount of fuel carried in the wings and an extra bay was inserted in the fuselage behind the engine to accommodate an additional fuel tank. The lengthening of the fuselage forward called for increased fin area aft.

In April of 1940 the decision had been taken to make a trial installation of the Bristol Centaurus engine in the Tornado and in September, 1941, the Centaurus-Tornado prototype was ready for flight trials at the same time as the introduction of the Typhoon II was under discussion. It was just at this time that production of the Tornado was stopped owing to the limited production of the Rolls-Royce Vulture engine, and thenceforth the Centaurus installation became related to the Typhoon. It was not possible to install a Centaurus engine in a Typhoon I fuselage and it was decided in June, 1942, to fit this engine in the Typhoon II, in which the front spar, because of the additional fuselage bay, was further aft in relation to the engine and no longer in the way. Thus, at that stage there were two possible engine installations for the Typhoon II, so far as production was concerned.

Owing, however, to delay in the production of the Sabre IV engine, it was decided to complete the prototype Typhoon II with a Sabre II engine and, to avoid confusion and also because the Mk. II had become a completely different aeroplane both in external appearance and in internal construction, permission was sought to rename it. Eventually the name Tempest was chosen.

In June, 1942, it was proposed that six Tempest prototypes should be completed, one with the Sabre IV (Tempest I), two with the Centaurus V (Tempest II), one with a Rolls-Royce Griffon IIB (Tempest III), one with a Griffon 61 (Tempest IV) and one with the Sabre II (Tempest V). Owing to heavy commitments the Hawker company could not undertake to build more than three prototypes at that time and the Marks I, II and V were chosen.

The Tempest V prototype first flew on September 2, 1942, the Tempest I on February 24, 1943, and the Tempest II on June 28, 1943. The Tempest I with Sabre II engine and wing radiators was not proceeded with as the effect of burying the

A Hawker Tempest VI (Napier Sabre VI engine) fitted with an experimental annular ring radiator installation developed by the Napier company.

***HAWKER**—continued.*

radiators in the wings was negligible except at height, whereas the question of their vulnerability was open to argument. As the Sabre II was a well-tried power-unit and available in quantity the Mk. V was the first Tempest to go into production. The first production Tempest V appeared on June 25, 1943, and this mark, which first went into action early in 1944, was the only one of the Tempest series to see active service in the war.

The Mk. II with the Centaurus V engine and full tropical equipment followed the Mk. V in production for service in the Far East.

In the meantime the Sabre IV engine was developed into the Mk. V and in October, 1943, it was decided to make a trial installation of the Sabre V in a Tempest with radiator and oil cooler taking up the whole of the nose duct and with the air intakes located in the wing leading-edge alongside the fuselage. This version became the Tempest VI, the first flight of the prototype taking place in June, 1944. With tropical equipment added the Mk. VI also went into production for overseas service.

TYPE.—Single-seat Fighter and Fighter-Bomber.

WINGS.—Low-wing cantilever monoplane. Hawker H.14/14/37.5 aerofoil section at roots. H.14/10/37.5 at tips, with maximum thickness at 37.5% of chord Datum line horizontal as far as main landing-gear attachments, 5½° dihedral outboard of these points. Semi-elliptical plan form with squarish-cut tips. Each half wing attached direct to centre fuselage. Wing structure similar to that of Fury. Incidence 1°, Root chord 9 ft. 0½ in. (2.75 m.), Mean chord 7 ft. 4 in. (2.24 m.), Gross wing area 302 sq. ft. (28 sq. m.), Ailerons and flaps as for Fury. Total aileron area 24.57 sq. ft. (2.28 sq. m.). aileron movement 15½° up, 18° down. Total flap area 37.86 sq. ft. (3.52 sq. m.), Maximum flap movement 80° down.

FUSELAGE.—All-metal structure in four portions, steel-tube engine mounting and centre fuselage, and monocoque rear fuselage and tail portion. Spars of wings are attached to the centre fuselage, a tubular girder continuing the front spar and a steel casting the rear spar across the fuselage.

TAIL UNIT.—Cantilever monoplane type. Port and starboard tail-planes are separate and interchangeable and bolted to fittings projecting from sides of fuselage tail end. Aerodynamically and statically balanced separate and interchangeable elevators. Fin integral with fuselage. Mass-balanced rudder. Tailplanes and elevators of all-metal stressed-skin construction. Rudder has metal frame with fabric covering. Controllable trim-tabs in both elevators and rudder. Area of tailplane and elevators 44.5 sq. ft. (4.13 sq. m.), area of single elevator with tab 7.75 sq. ft. (0.72 sq. m.), area of rudder with tab 12.87 sq. ft. (1.195 sq. m.). Elevator movement 20° 30′ down, elevator tab movement 10° up and down. Rudder movement 20° 30′ either side, rudder tab movement 11° either side.

LANDING GEAR.—Retractable type similar to that of Fury. Track 14 ft. 10½ in. (4.54 m.).

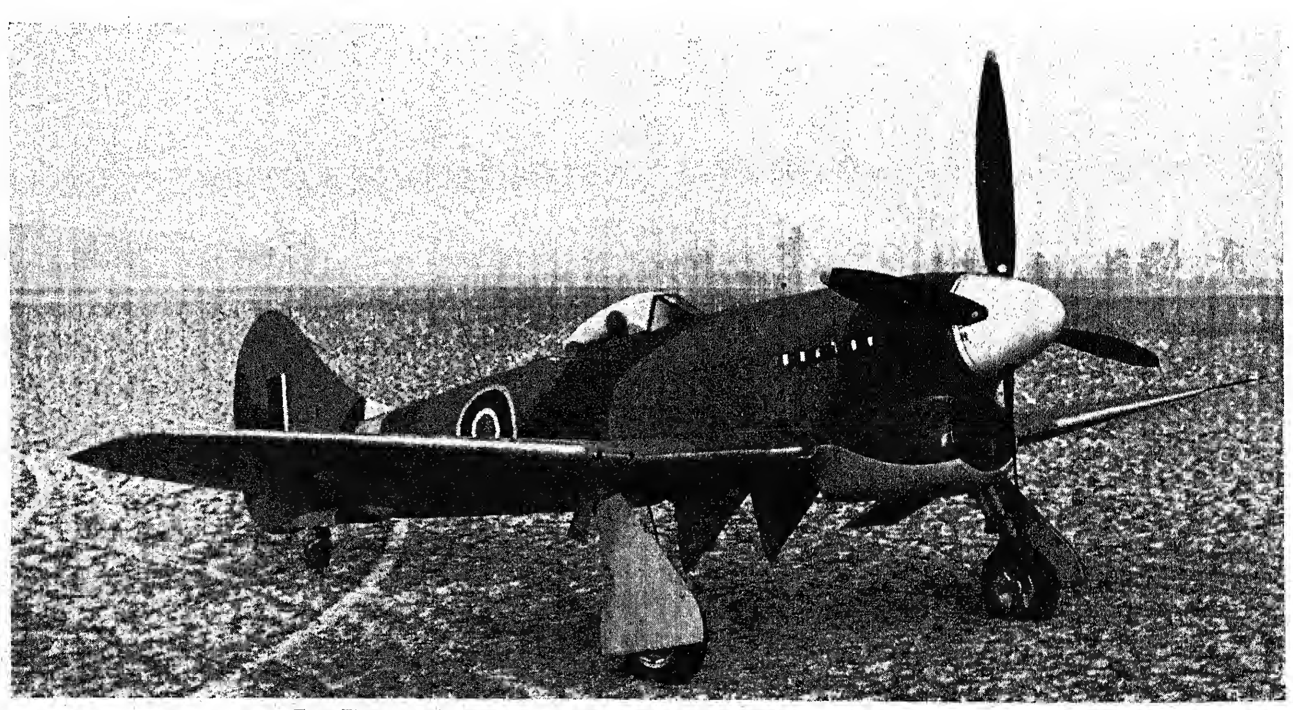
POWER PLANT. (Tempest II)—One Bristol Centaurus V eighteen-cylinder two-row radial air-cooled sleeve-valve engine with maximum rating (5 min.) of 2,530 h.p. at 1,000 ft. (305 m.) and 2,225 h.p. at 11,000 ft. (3,355 m.) and with a maximum take-off output (100/150 Grade fuel) of 2,590 h.p. Rotol four-blade constant-speed airscrew 12 ft. 9 in. (3.88 m.) diameter. Low-drag ducted cowling with thermostatically-controlled sliding shutters at trailing-edge. Carburettor supplied with warm, cold or filtered air. Normal air intakes in wing leading-edge roots alongside fuselage. Filtered air taken in through 48 louvres in rear top cowling panel and passed through Vokes air cleaner. Four internal self-sealing fuel tanks, main tank (76 Imp. gallons=345 litres) in fuselage, two interspar wing tanks outboard of wheel wells (28 Imp. gallons= 127 litres each) and one port wing leading-edge tank (28 Imp. gallons=127

A further development of the Napier experimental annular radiator on the Tempest VI, here fitted with a ducted cooling spinner.

litres). Total internal fuel capacity 160 Imp. gallons (726 litres). Two auxiliary drop tanks of 45 or 90 Imp. gallons (205 or 409 litres) each may be carried under wings. Wing tanks pressurised to feed to main tank. Oil tank (14 Imp. gallons=64 litres effective capacity) in fuselage. Oil cooler in starboard wing leading-edge outboard of air intake.

POWER PLANT (Tempest V).—One Napier Sabre IIB twenty-four-cylinder H-type liquid-cooled sleeve-valve engine with a maximum rating (5 min.) of 2,420 h.p. at sea level and 2,045 h.p. at 13,750 ft. (4,190 m.) and with a take-off output of 2,010 h.p. D.H. Hydromatic four-blade airscrew 14 ft. (4.27 m.) diameter. Coolant radiator and oil cooler in low-velocity duct under engine, with air intake in centre of assembly. Four internal self-sealing fuel tanks as in Mk. II. Tanks can be pressurised against air-lock at altitude. Oil tank (16 Imp. gallons=73 litres effective capacity) in fuselage.

POWER PLANT (Tempest VI).—One Napier Sabre V twenty-four-cylinder H-type liquid-cooled sleeve-valve engine with maximum rating (5 min.) of 2,600 h.p. at 2,500 ft. (760 m.) and 2,300 h.p. at 12,750 ft. (3,890 m.) and with 2,300 h.p. available for take-off. D.H. Hydromatic four-blade airscrew 14 ft. (4.27 m.) diameter. Coolant radiator taking full cross-section of low-velocity duct with oval "slab" type oil cooler bolted to rear of coolant radiator. Additional thermostatically-controlled oil cooler in starboard wing. Normal



The Hawker Tempest VI Single-seat Fighter (Napier Sabre V engine).

HAWKER—*continued*.

air intakes in wing leading-edge alongside fuselage. On ground carburettor air taken in through intake fitted with air-cleaner under engine cowling. Internal fuel tankage as for Mk. V. Pressurised wing tanks as in Mk. II. Oil tank (22 Imp. gallons=100 litres) effective capacity in fuselage.

Accommodation.—Single cockpit over trailing-edge of wing. Single-piece Perspex blister-type optically-perfect sliding canopy. Bullet-proof windshield. Armour protection for pilot, ammunition boxes and fuel system. Cockpit heating.

Armament.—Four 20 m/m. British Hispano Mk. V cannon, two in each wing outboard of landing-gear attachments. In Tempest Mk. V Series I the longer Mk. II cannon which protruded slightly from the wings were fitted. All other Tempest marks have the shorter Mk. V cannon which are completely buried within the wings. Two 500 lb. (227 kg.) or 1,000 lb. (454 kg.) bombs may be carried under wings. Racks for rocket-projectiles may also be fitted.

Equipment.—24-volt electrical system. Camera-gun, oxygen, transmitting and receiving and beam-approach radio. Tropical and desert equipment in Mks. II and VI.

Dimensions (Tempest II).—Span 41 ft. (12.5 m.), Overall length 34 ft. 5 in. (10.5 m.), Height (tail up, one blade vertical) 13 ft. 6 in. (4.12 m.), Height (tail down, one blade vertical) 14 ft. 6 in. (4.42 m.).

Dimensions (Tempest V and VI).—Span 41 ft. (12.5 m.), Overall length 33 ft. 8 in. (10.26 m.), Height (tail up, one blade vertical) 14 ft. 10 in. (4.5 m.), Height (tail down, one blade vertical) 16 ft. 1 in. (4.9 m.).

Weights and Loadings (Tempest II).—Weight loaded (Fighter) 11,800 lbs. (5,260 kg.), Weight loaded (Fighter-Bomber—2 × 500 lbs.=227 kg. bombs) 12,800 lbs. (5,810 kg.), Weight loaded (Fighter-Bomber—2 × 1,000 lbs.=454 kg. bombs) 13,800 lbs. (6,265 kg.), Weight loaded (Long-range Fighter—2 × 90 Imp. gallon=407 litres drop tanks) 13,300 lbs. (6,040 kg.), Wing loading (at 13,300 lbs.=6,040 kg.) 44 lbs./sq. ft. (214.8 kg./sq. m.), Power loading (at 13,300 lbs.=6,040 kg. take-off power) 5.1 lbs./h.p. (2.3 kg./h.p.).

Weights and Loadings (Tempest V).—Weight loaded (Fighter) 11,400 lbs. (5,176 kg.), Weight loaded (Fighter-Bomber—2 × 500 lb. bombs) 12,500 lbs. (5.675 kg.), Weight loaded (Fighter-Bomber—2 × 1,000 lb. bombs) 13,500 lbs. (6,130 kg.), Wing loading (at 13,500 lbs.=6,130 kg.) 44.7 lbs./sq. ft. (218.24 kg./sq. m.), Power loading (at 13,500 lbs.=6,130 kg. take-off power) 6.7 lbs./h.p. (3.03 kg./h.p.).

Weights and Loadings (Tempest VI).—Weight loaded (Fighter) 12,000 lbs. (5,450 kg.), Wing loading (approximate) (at 12,000 lbs. =5,450 kg.) 39.4 lbs./sq. ft. (192.3 kg./sq. m.), Power loading (at 12,000 lbs.=5,450 kg. take-off power) 5.2 lbs./h.p. (2.35 kg./h.p.).

Performance (Tempest II).—Maximum speed 440 m.p.h. (704 km.h.) at 17,000 ft. (5,185 m.), Speed at 29,000 ft. (8,845 m.) 410 m.p.h. (656 km.h.), Speed at sea level 400.6 m.p.h. (641 km.h.), Climb at combat rating (100/130 Grade fuel) 18,000 ft. (5,490 m.) in 5 min., Climb at combat rating (100/150 Grade fuel) 20,000 ft. (6,095 m.) in 5 min., Radius of action (with max. internal fuel and 2 × 45 Imp. gallon=204 litre drop tanks, and allowing for 5 min. run-up, climb to 20,000 ft. = 6,095 m., 15 min. combat and return with 20% reserve of fuel) 420 miles (672 km.).

Performance (Tempest V).—Maximum speed 435 m.p.h. (696 km.h.), at 17,000 ft. (5,185 m.), Speed at sea level 390 m.p.h. (624 km.h.), Climb to 20,000 ft. (6,100 m.) at combat rating 6 min.

Performance (Tempest VI).—Maximum speed 450 m.p.h. (720 km.h.) at 14,500 ft. (4,420 m.), Speed at sea level 395 m.p.h. (632 km.h.). Speed at 30,000 ft. (9,150 m.) 425 m.p.h. (680 km.h.), Climb to 20,000 ft. (6,100 m.) at combat rating 4 min. 45 sec.

HAWKER-SIDDELEY.

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Registered Office: 55-56, Pall Mall, London, S.W.1.

Directors: T. O. M. Sopwith, C.B.E., F.R.Ae.S. (Chairman), Sir Frank Spencer Spriggs, Hon. F.R.Ae.S. (Managing Director,) H. Burroughes, F.R.Ae.S., Sir Roy Dobson, C.B.E., F.R.Ae.S. and H. A. Meredith, O.B.E.

The Hawker-Siddeley Aircraft Co., Ltd., which was formed in 1935, is the controlling organization of Sir W. G. Armstrong Whitworth Aircraft, Ltd., Armstrong Siddeley Motors, Ltd., Gloster Aircraft, Ltd., Hawker Aircraft, Ltd., A. V. Roe & Co., Ltd., A. V. Roe (Canada), High Duty Alloys, Ltd. and Air Service Training Ltd.

The component companies of the Hawker-Siddeley Group were responsible for providing approximately 30% of all the equipment supplied by the British Aircraft Industry to the R.A.F. throughout the whole period of the European War. Total deliveries consisted approximately of 40,089 aircraft, inclusive of spares, and 38,564 aero-engines. In addition, the Group repaired 11,010 aircraft and 9,777 aero-engines. Aircraft production in the group rose from 1,753 in 1938-39 to a peak figure of 8,795 in 1943-44, the latter figure not including 2,190 repaired or re-conditioned aircraft. Engine production rose from 2,175 in 1938-39 to 8,008 in 1942-43.

Factory space increased from a floor area of 2,000,000 sq. ft. (185,800 sq. m.) in 1938 to 15,000,000 sq. ft. (1,393,500 sq. m.) in 1944 and the rate of new aircraft production from 60 to 600 per month.

HESTON.

THE HESTON AIRCRAFT CO., LTD.

Head Office: Heston Airport, Hounslow, Middlesex.

Works: Heston, Middlesex, and Slough, Bucks.

Chairman: Sir Norman J. Watson, Bt.

Managing Director: B. R. S. Jones.

Directors: G. A. Lingham, D.F.C., Lieut. Col. G. C. Golding and Group Capt. G. H. Bowman, D.S.O., M.C., D.F.C.

Chief Designer: G. Cornwall, B.A., A.F.R.Ae.S.

This Company was originally formed as the Comper Aircraft Co. Ltd., in 1929, the name being changed to the present title in 1934.

In 1935 the Company produced the Phoenix five-seat cabin monoplane, which was described and illustrated in the 1938 issue of this Annual. In 1938 the Company designed and built two prototype elementary training monoplanes for the Air Ministry to Specification T.1/37.

At the end of 1938 the Company began design work on a small low-wing monoplane known as the Heston Special, with which it was hoped to establish a new World's Speed Record. This aircraft had a span of 32 ft. 0½ in. (9.76 m.) and was powered by a 2,300 h.p. Napier Sabre twenty-four cylinder H engine. It made its first flight on June 12, 1940, but a forced landing was made due to cooling trouble, and the aircraft was destroyed. Further development was abandoned.

Throughout the War the Company was engaged on specialised design and research work for the Directorate of Technical Development, and included the design and construction of a half-scale Boulton Paul F.11/37 fighter (which see), and the design and construction of the wing-folding gear and other features of the D.H. Sea Hornet (see under "De Havilland"). Early in the War Heston Aircraft undertook the installation of cameras in Spitfires for the Photographic Development Unit, which subsequently formed the nucleus of the entire Photographic Reconnaissance system.

Rocket-assisted take-off experiments were made by Heston Aircraft with Spitfire, Seafire, Barracuda, Swordfish and Chesapeake aircraft, and the Company perfected the R.A.T.O.G. now used in this country. Other work included modification of various types of American aircraft, including the Thunderbolt, Chesapeake, Argus and Vigilant, for British use. Component parts for the Wellington, Warwick, Spitfire, Walrus, Sea Otter, Lerwick, Mosquito and Hornet were produced in large numbers, and the Company's Repair Branch returned 650 Spitfires to the R.A.F.

The installation of the Turbinlite on the R.A.F. Douglas Havoc, and the production of the twelve-gun nose designed by the Martin-Baker Aircraft Company for this aircraft was also undertaken by the Heston Aircraft Co., Ltd.

The Company has now designed a twin-boom Air Observation Post monoplane to Specification A.2/45, a description of which follows.

THE HESTON A.O.P. MONOPLANE.

The Heston Air Observation Post twin-boom pusher monoplane is a two-seat aircraft designed to Specification A.2/45, and at the time of writing the first prototype was under construction. Four have been ordered by the Ministry of Supply.

The A.O.P. is of all-metal construction and consists of a central nacelle carrying the crew of two in tandem, with a D.H. Gipsy Queen 33 six-cylinder in-line inverted air-cooled engine mounted on a forged steel bearer as a pusher unit and driving a two-blade variable-pitch propeller. The wing is mounted in a low-mid position and consists of a constant-chord centre-section with a straight trailing-edge and a sweptback leading-edge. Slotted trailing-edge flaps are fitted between the ailerons and the nacelle, divided by the tail-booms. Full-span slots are fitted to the leading-edge.

The tail-unit consists of twin fins and rudders mounted above the tail-booms, with a constant-chord tailplane and one-piece elevator between. The landing gear is a non-retractable tricycle, each main wheel being carried in a fork on a Lockheed shock-absorber leg attached to the centre-section. The nose-wheel is similarly mounted under the nacelle.

Dimensions.—Span 44 ft. 0 in. (13.41 m.), Length 34 ft. 0 in. (10.36 m.), Height 9 ft. 0 in. (2.74 m.), Wing area 274 sq. ft. (25.45 sq. m.).

Weights and Loadings (Designed).—Weight loaded (normal) 3,050 lbs. (1,383 kg.), Wing loading 11.13 lbs./sq. ft. (54.3 kg./sq. m.).

Performance.—No data available.

MARTIN-BAKER.

MARTIN-BAKER AIRCRAFT CO., LTD.

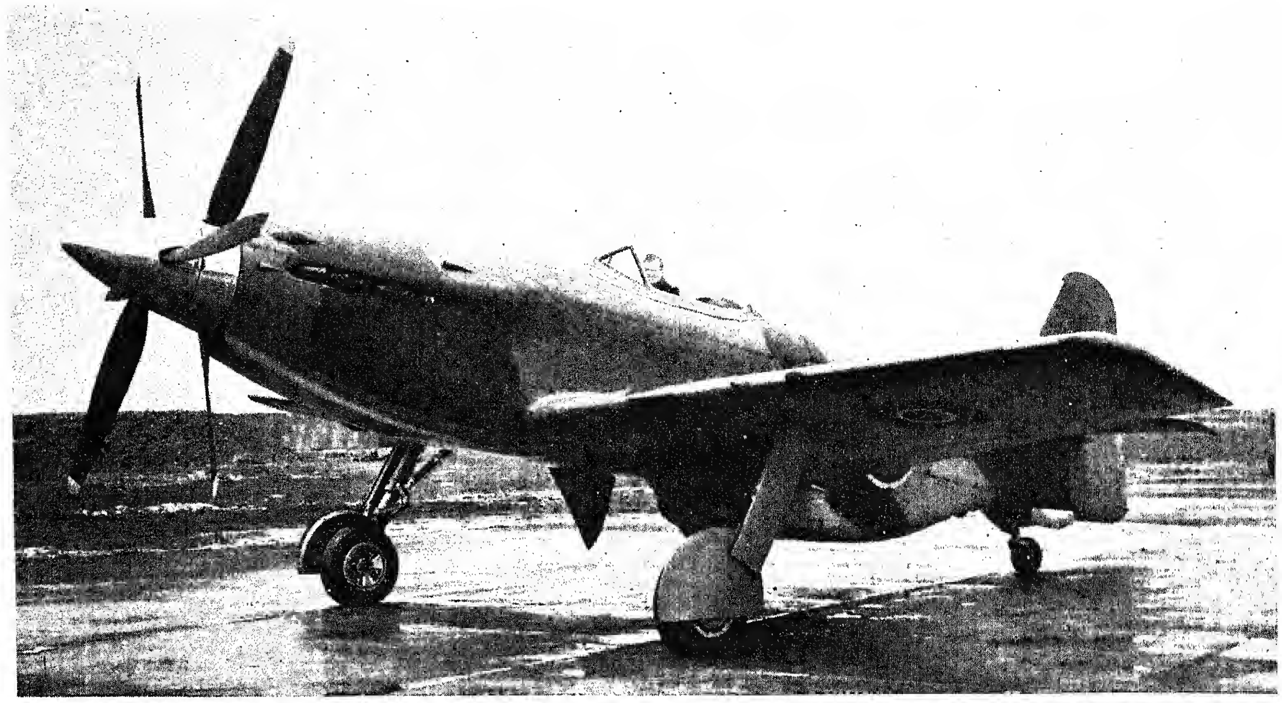
Head Office and Works: Higher Denham, near Uxbridge, Middlesex.

Managing Director and Chief Designer: James Martin.

The Martin-Baker Aircraft Co. Ltd. was formed in 1934 to exploit a special system of steel-tube construction evolved by Mr. James Martin. This construction was embodied in the Company's first production, the MB-1, which was described and illustrated in the 1936 edition of this work.

In 1939 details were released concerning an experimental single-seat eight-gun fighter monoplane, the MB-2, which the

***MARTIN-BAKER**—continued.*



The Martin-Baker M.B. 5 Single-seat Fighter (2,305 h.p. Rolls-Royce Griffon 83 engine).

Company built to the order of the Air Ministry. This machine made use of the Martin system of steel-tube construction. Brief details of this aircraft were published in the 1940 issue of this Annual.

Two further prototype fighters completed were the MB-3 with a Napier Sabre engine and the MB-5 with a Griffon 83 engine driving contra-rotating airscrews. Both were built to Specification F.18/39.

The Company has also been engaged in the development of numerous aircraft accessories, and has executed modification work for the M.A.P.

The Martin patent blast tubes, which had been fitted on the MB-2, were subsequently used on Hawker Hurricanes and Typhoons, D.H. Mosquitos and other aircraft. Over 100,000 were manufactured during the war years.

The Martin-Baker explosive cable-cutter was developed between 1937 and 1939, and was standardised for British bombers just before the outbreak of war. Each cutter weighed about 3 lb. (1.36 kg.) and was capable of cutting a 16-ton balloon cable. Immediately preceeding a raid on the Dortmund-Ems Canal in 1940 two Handley Page Hampdens fitted with these cutters were used to clear the area of balloons to allow the main attack force to enter. About 250,000 of these cutters were manufactured, 80,000 by the Company.

The Company was also responsible for the design of a 12-gun nose to be fitted to the R.A.F. Douglas Boston to convert it into the British Havoc night-fighter. This design work was completed in about 2½ months, and about 100 noses were manufactured by the Heston Aircraft Co. Ltd.

The Company has devoted much effort to the development of pilot ejection seats. In September, 1944, experiments began with an explosive seat, and on May 11, 1945, the first flying trials were made at Wittering with a seat fitted in a Boulton Paul Defiant. In subsequent tests successful dummy ejections were made up to a speed of 360 m.p.h. (576 km.h.). The first "live" automatic ejection was made from a specially-equipped two-seat Gloster Meteor on July 24, 1946. The Martin-Baker ejection seat is a standard fitment on the Gloster Meteor, and it is also being applied to aircraft developed by the Supermarine, Saunders-Roe, Armstrong-Whitworth and English Electric companies. It is also being supplied to the U.S. Navy.

In January, 1945, a test rig was built to accustom pilots to the sensation of being ejected, and a pressure curve compiled from the information obtained therefrom has been approved by the Physiological Department of the Royal Aircraft Establishment, Farnborough, and is now standard for the R.A.F. A 110 ft. (33.5 m.) test-rig has also being supplied to the U.S. Navy Bureau of Aeronautics.

Other Martin-Baker developments include a jettisonable hood for the Spitfire and other aircraft, and a patented automatic oiling unit for contra-rotating airscrews.

THE MARTIN-BAKER M.B.5.

The Martin-Baker Aircraft Co., Ltd., designed and built two single-seat fighter aircraft to meet the requirements of the Air Ministry Specification F.18/39. The first was the M.B.3, which was fitted with a 2,020 h.p. Napier Sabre II twenty-four cylinder H-type liquid-cooled engine driving a D.H. Hydromatic three-blade constant-speed airscrew. This aeroplane was designed for an armament of six wing-mounted 20 m/m. cannon. It first flew on August 31, 1942. On one of its test flights the M.B.3 was forced to land through engine trouble and in a collision with a tree after touching down the aircraft was destroyed and the pilot, Capt. V. E. Baker, a director of the company, was killed.

A completely new layout was adopted for its successor, the M.B.5, using a Rolls-Royce Griffon 83 twelve-cylinder Vee liquid-cooled engine driving two D.H. three-blade contra-rotating airscrews. This aeroplane first flew on May 23, 1944.

Particular attention has been paid to the layout of the cockpit, with well-designed control and instrument installations.

TYPE.—Single-seat Fighter.

WINGS.—Cantilever low-wing monoplane. Aerofoil section R.A.F. 34. Straight-tapered structure with single spar of laminated metal plate and D-section leading-edge together forming torsion box. Pressed ribs, longitudinal stringers and stressed metal skin. Detachable tips. Incidence 1½ degrees; dihedral 4½ degrees; root chord (on fuselage centre-line) 10 ft. 0 in. (3.05 m.); projected tip chord 5 ft. 1½ in. (1.55 m.); aspect ratio 4.66; nett wing area 233 sq. ft. (21.63 sq. m.); gross wing area 263 sq. ft. (24.41 sq. m.). Metal ailerons with spring servo tabs. Aileron area (total) 15 sq. ft. (1.39 sq. m.). Pneumatically-operated split trailing-edge flaps between ailerons and fuselage. Flap area (total 28 sq. ft. (2.59 sq. m.).

FUSELAGE.—Steel-tube structure with covering of quickly-detachable metal panels. Maximum depth 5 ft. 3.3 in. (1.6 m.), maximum width 3 ft. 7½ in. (1.1 m.).

TAIL UNIT.—Cantilever monoplane type. Metal structure with horn-balanced rudder and elevators. Trim-tabs in rudder and starboard elevator; trim and balance-tabs in port elevator. Tail-plane span 15 ft. 6 in. (4.72 m.); root chord 5 ft. 11 in. (1.8 m.); tip chord (6 ft. 11 in.=2.11 m. from fuselage centre line) 3 ft. 0¾ in. (0.93 m.); total horizontal area 65.75 sq. ft. (6.1 sq. m.); elevator area (total) 25 sq. ft. (2.32 sq. m.); total vertical area 31 sq. ft. (2.87 sq. m.), fin area 13.8 sq. ft. (1.28 sq. m.); rudder area 17.2 sq. ft. (1.6 sq. m.); fin and rudder root chord (on centre-line top longeron) 6 ft. 9½ in. (2.07 m.); tip chord (6 ft. 3 in.= 1.9 m. above centre-line top longeron) 2 ft. 3.7 in. (0.7 m.).

LANDING GEAR.—Retractable two-wheel type. Main wheels 30.8 in. × 9.35 in. (965 m/m. × 394 m/m.) each carried on inside of single shock-absorber strut with side bracing strut which retracts inwards into wing and is enclosed by fairing plates attached to legs and by hinged doors under wing roots. Track 15 ft. 2 in. (4.62 m.); tyre pressure 60 lbs./sq. in. (4.22 kg./sq. c/m.). Tail wheel 14.9 in. × 5.92 in. (377 m/m. × 150 m/m.) carried on levered suspension shock-absorber leg retracts rearwards into fuselage and is enclosed by twin doors. Tyre pressure 40 lbs./sq. in. (2.8 kg./sq. c/m.). Pneumatic operation.

POWER PLANT.—One Rolls-Royce Griffon 83 twelve-cylinder vee liquid-cooled engine rated (for five minutes) at 2,305 h.p. in M gear at 550 ft. (170 m.) at 2,750 r.p.m. with 25 lbs./sq. in. (1.76 kg./sq. c/m.) boost; 2,060 h.p. in S gear at 15,700 ft. (4,785 m.) at 2,750 r.p.m. with 25 lbs./sq. in. (1.76 kg./sq. c/m.) boost; 1,900 h.p. in M gear at 2,750 r.p.m. with 18 lbs./sq. in. (1.26 kg./sq. c/m.) boost for take-off; and a maximum weak mixture output of 1,290 h.p. in M gear at 12,600 ft. (3,840 m.) at 2,400 r.p.m. with 7 lbs./sq. in. (0.49 kg./sq. c/m.) boost. Engine flexibly mounted on two molybdenum steel A-booms. D.H. Hydromatic contra-rotating co-axial three-blade metal airscrews; (front) SKP 74489/15A, 11 ft. 9 in. (3.58 m.) diameter; (rear) SKP 74490/18A 11 ft. 7½ in. (3.54 m.) diameter. Reduction gear ratio 0.442. Rolls-Royce-Bendix-Stromberg injection carburettor. Intercooler, main cooler and oil-cooler in one laminar-flow duct under fuselage. Radiator

MARTIN-BAKER—continued.

matrix area 4.85 sq. ft. (0.35 sq. m.). Fuel capacity 200 Imp. gallons (910 litres) in protected tanks in fuselage. Oil capacity 14 Imp. gallons (64 litres).

ACCOMMODATION.—Pilot's cockpit just aft of wing leading-edge has flat bullet-proof windscreen, and moulded blister type canopy which slides for access and can be jettisoned.

ARMAMENT.—Four 20 m/m. British Hispano cannon mounted two in each wing outboard of landing-gear and airscrew disc, with 200 r.p.g.

DIMENSIONS.—Span 35 ft. 0 in. (10.7 m.), Length 37 ft. 9 in. (11.5 m.), Height (tail up, over rudder) 14 ft. 0 in. (4.27 m.), Height (over airscrew, one blade vertically upwards) 12 ft. 6 in. (3.81 m.).

WEIGHTS AND LOADINGS.—Weight empty 9,233 lbs. (4,188 kg.), Total removable load 1,182 lbs. (536 kg.), Fuel and oil 1,675 lbs. (760 kg.), Weight loaded 12,090 lbs. (5,484 kg.), Wing loading (fully loaded) 45.9 lbs./sq. ft. (224 kg./sq. m.), Power loading at take-off 6.3 lbs./h.p. (2.85 kg./h.p.).

PERFORMANCE.—Maximum speed, over 450 m.p.h. (720 km.h.).

MILES.

MILES AIRCRAFT, LTD.

HEAD OFFICE AND WORKS: READING, BERKS.

Directors: F. G. Miles, F.R.Ae.S., Mrs. M. F. M. Miles, G. H. Miles and Sir Wm. Mount.

Associated Companies:—

Miles Aircraft (Northern Ireland) Ltd., Banbridge, Co. Down, Northern Ireland.

Miles Aircraft (Pty.) Ltd., General Mining Building, 70, Main Street, Johannesburg, South Africa.

Miles Aircraft Ltd. was formerly known as Phillips & Powis Aircraft Ltd., which had been formed in March, 1935, as a public company to take over the aircraft manufacturing business previously conducted by Phillips & Powis Aircraft (Reading) Ltd. The Company assumed its present title in October, 1943.

The Company's latest types are the M-65 Gemini twin-engined four-seat cabin monoplane and the M-60 Marathon 14/20-seat monoplane powered by four D.H. Gipsy Queen engines. Also in production are the M-57 Aerovan twin-engined ten-seat monoplane. and the M-38 Messenger, which was built originally as a military communications monoplane and has since been made available for civilian purposes. The M-28 is in use in limited numbers by the R.A.F. and also as a civilian aircraft.

The M-33 Monitor twin-engined Target-Tug and the M-25 Martinet Target-Tug monoplanes have also been produced, the latter in large numbers. The Queen Martinet is a radio-controlled pilotless version of the Martinet, and an Advanced Trainer version is designated the M-37.

The M-14 Magister (which was first produced in 1937, and which was last described in the 1945-46 edition of this work) was the first monoplane in Great Britain to be approved by the Air Ministry for *ab initio* instruction of R.A.F. pilots, and it is still in use in R.A.F. training establishments in England and overseas. Production ceased early in 1941, after 1,203 had been delivered to the R.A.F. Some of these have since been returned to the manufacturers and have been re-conditioned for the Air Forces of Turkey, Chile, Eire, Portugal and the Argentine. Others are in civilian use both in this country and overseas.

The Master two-seat advanced training monoplane has appeared in the Mk. I, II and III versions, and a total of 3,201 were built, the last, a Mk. III being completed in 1942. Descriptions of the Master II and III appeared in the 1945-46 edition of "All the World's Aircraft."

At the time of writing Miles Aircraft are engaged in further developing the Libellula tandem-wing monoplane (also described in the last edition of this work), the jet-propelled M-63B being projected for mail-carrying duties. Experiments are also being made with aircraft for operating at supersonic speeds and the M.52 designed to Specification E.24/43 for this purpose is described herewith.

Licences have been granted to Société Atalante, 110, Rue Michel Ange, Paris, for the manufacture of the M-65 Gemini, M-57 Aerovan and M-38 Messenger in France.

Miles Aircraft operates a Technical School at Woodley Aerodrome and the students have designed a high-wing monoplane to be powered by two D.H. Gipsy Six engines. This aircraft, known as the Venture, was under construction at the time of writing.

THE MILES M-65 GEMINI.

The Gemini is a four-seat cabin monoplane which has been developed from the M-38 Messenger. It uses a similar fuselage, wings and tail-unit, except that only twin fins and rudders are fitted. The prototype, G-AGUS, was first flown on October 26, 1945, at Woodley with a fixed landing-gear. This was later made to retract and production aircraft are so fitted.

TYPE.—Twin-engined four-seat Cabin monoplane.

WINGS.—Wooden cantilever low-wing monoplane. Two-spar structure built in one piece, spars passing through fuselage. Wooden box-spars with false spars in front of and behind rear spar extending outwards to ailerons. Plywood former ribs and plywood covering. Trailing-edge of metal strip. Wing roots faired to fuselage with light alloy fillets. Aspect ratio 6.86. Gross wing area 191 sq. ft. (17.74 sq. m.). All-wood ply-covered slotted ailerons droop with flaps. Miles non-retractable auxiliary aerofoil flaps hinged at three points to trailing-edge. All-wood construction of symmetrical section.

FUSELAGE.—All-wood structure built in two main pieces bolted together aft of rear spar. Each portion has four spruce longerons and U-frames each composed of outer and inner laminated spruce members interspaced by blocks and reinforced where necessary. Stressed plywood covering. Phenol-formaldehyde plastic bonding. Strengthened rear portion covered with light alloy panels. Inspection panels in floor under cabin and rear fuselage. Maximum fuselage width 4 ft. 0 in. (1.22 m.).

TAIL UNIT.—All-wood structure with plywood skin. Cantilever tailplane attached to top longerons, with twin fins and rudders as endplates. Elevators and horn-balanced rudders of wooden construction with plywood covering. Controllable trim-tabs in elevators. Tailplane span (overall) 12 ft. 9 in. (3.88 m.).

LANDING GEAR.—Retractable type, each unit consisting of a single shock-absorber leg hinged to front spar and retracting backwards into nacelle, being fully enclosed by twin doors. Track 10 ft. 11 in. (3.32 m.). Non-retractable tailwheel carried in fork on shock-absorber strut.

POWER PLANT.—Two 100 h.p. Blackburn Cirrus Minor II four-cylinder in-line inverted air-cooled engines driving two-bladed fixed-pitch airscrews, 6 ft. 6 in. (1.98 m.) diameter. Two 18 Imp. gallon (82 litre) and (optionally) two 12 Imp. gallon (55 litre) crash-proof fuel tanks in centre section. Oil capacity 4 Imp. gallons (18 litres).

ACCOMMODATION.—Enclosed air-conditioned and sound-proofed cabin seating four; two separate seats in front with wide cross-seat behind. Pilot's seat in front (on starboard) adjustable on ground. Dual control optional. Maximum interior width 3 ft. 9 in. (1.14 m.). Counter-balanced access doors on each side hinged on top centre-line of fuselage and fitted with emergency jettison gear. Front seats hinge forward to allow access to floor stowage. Perspex one-piece moulded windscreen, side and roof panels. Luggage compartment in nose. Seats removable to allow use as light freighter, or as ambulance with special detachable panel 6 ft. 0 in. (1.83 m.) long, and rubber-mounted stretcher supports, with accommodation for pilot and attendant. Extra sound-proofing.

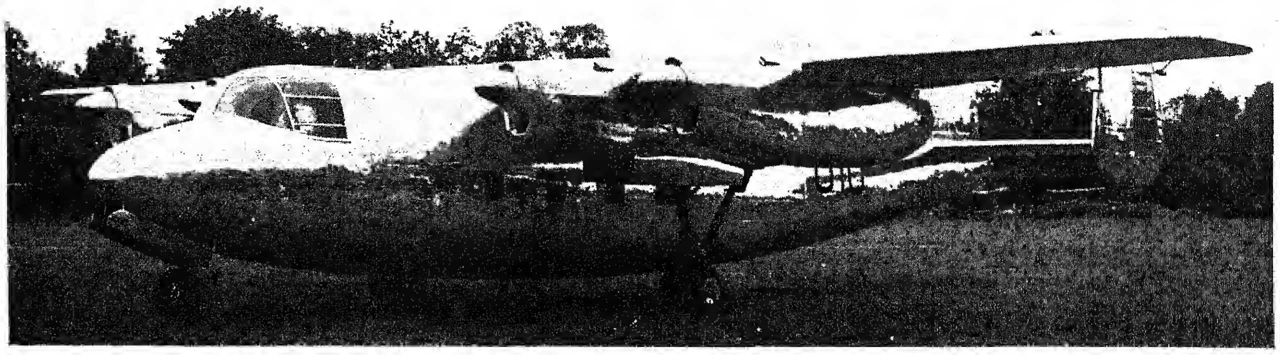
EQUIPMENT.—Provision for Decca navigator.

DIMENSIONS.—Span 36 ft. 2 in. (11.02 m.), Length 22 ft. 3 in. (6.78 m.), Height (tail down, over cabin) 7 ft. 6 in. (2.28 m.).

WEIGHTS AND LOADINGS.—Weight empty with full equipment 1,910 lbs. (866 kg.), Disposable load (normal) 1,227 lbs. (556 kg.), Disposable load (with full equipment) 1,090 lbs. (866 kg.), Maximum weight

The Miles Gemini Four-seat Cabin Monoplane (two 100 h.p. Blackburn Cirrus-Minor II engines).

***MILES**—continued.*



The prototype Miles Marathon with central fin and rudder (four 330 h.p. D.H. Gipsy Queen 71 engines).

loaded 3,000 lbs. (1,361 kg.), Wing loading (at 3,000 lbs.=1,361 kg.) 15.7 lbs./sq. ft. (76.65 kg./sq. m.), Power loading 15 lbs./h.p (6.8 kg./h.p.).

PERFORMANCE (Estimated at 2,800 lbs.=1,270 kg. loaded weight).—Maximum level speed 150 m.p.h. (241 km.h.), Cruising speed 130 m.p.h. (210 km.h.), Indicated stalling speed 35 m.p.h. (56 km.h.), Rate of climb at sea level 870 ft./min. (265 m./min.), Maximum still-air range with 36 Imperial gallons (164 litres) fuel, 520 mile (837 km.) (duration 5.8 hrs.), Maximum still-air range with 60 Imp. gallons (273 litres) fuel, 820 miles (1,320 km.) (duration 9.1 hrs.), Take-off run in 5 m.p.h. (8 km.h.) wind 120 yds. (110 m.), Take-off distance to 50 ft. (15 m.) in 5 m.p.h. (8 km.h.) wind, 310 yds. (283 m.), Landing run in 5 m.p.h. (8 km.h.) wind 125 yds. (114 m.).

THE MILES M-60 MARATHON.

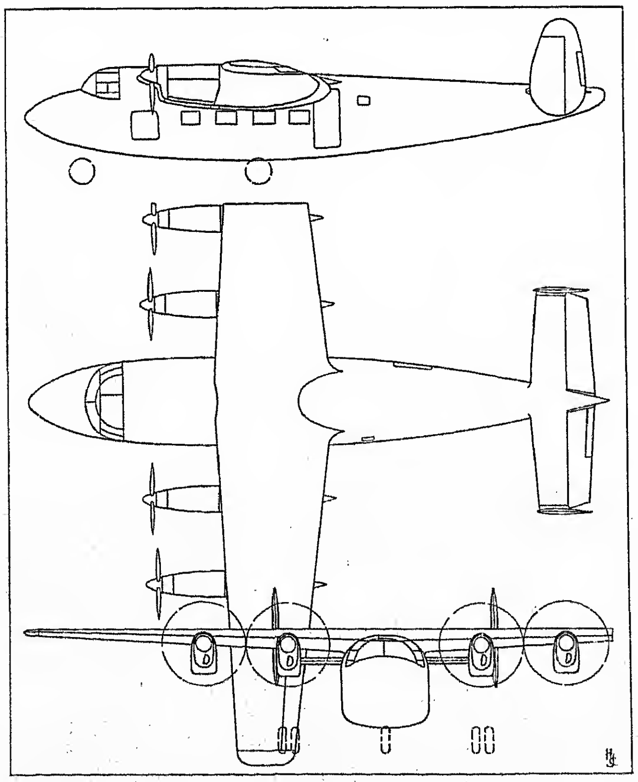
The Marathon was designed to Specification 18/44 to meet the requirements of the Brabazon Type V class for a medium-range feeder-line aircraft. The first flight of the prototype was made at Woodley Aerodrome on May 19, 1946. This aircraft is fitted with a third central fin and rudder, but this will be deleted on production aircraft.

The design of the M-60 allows for the installation of two radial engines of approximately 500 h.p. each, or two gas turbine units.

A jet-propelled version of the Marathon with two Armstrong Siddeley Mamba engines is designated M-69. Twenty-five have been ordered by British European Airways.

TYPE.—Four-engined fourteen/twenty-passenger monoplane.

WINGS.—Cantilever high-wing monoplane. Aerofoil section NACA 23018 (root); NACA 23009 (tip). All-metal structure consisting of short stub-plane integral with fuselage; two half-centre-sections and two tapered outer wings, joined by high-tensile steel bolts. Single main spar of DTD 363A extruded alloy at 30% chord and with 30° sweepback, and closing member at 70% chord. Torsion box formed in centre-section. Sheet alloy ribs, and stressed metal skin. Double-thickness skin over fuel tanks in centre-section.



The Miles M-60 Marathon.

Incidence 4.5° constant to outer wing joints, and 2° wash-out to tips. Wing area 500 sq. ft. (46.45 sq. m.). Externally mass-balanced all-metal ailerons with controllable trim-tab in each. Retractable Miles auxiliary high-lift flaps between ailerons and fuselage, of riveted light-alloy construction. Pneumatic operation with emergency standby air control.

FUSELAGE.—All-metal monocoque structure consisting of 47 2½-in. (6.35 c/m.) pressed channel-section frames of light alloy (DTD 603.) with DTD 646 frames at heavily-stressed locations. Double frame at main spar attachment, with channel longeron between main spar bulkhead and rear wing attachment. Drawn section alloy sheet longitudinal stringers, and Alclad skin of 20-24 s.w.g. riveted on with mushroom-head rivets. Floor construction of pressed sheet alloy frames over which is covering of $\frac{1}{8}$-$\frac{5}{32}$ in. (3-4 m/m.) plywood. Bulkheads of 24 s.w.g. DTD 603 sheet behind pilot's compartment and behind front luggage compartment.

TAIL UNIT.—All-metal cantilever structure with twin fins and rudders mounted as endplates to tailplane. Tailplane has single spar at 54% chord of extruded DTD 363 alloy, with alloy straps reinforcing 24 s.w.g. alloy skin. Tailplane and fin and rudder aerofoil section, modified NACA 0012. Elevators and rudders have light alloy spars and pressed ribs with covering of 26 s.w.g. alloy. Elevators on set-back shrouded ball-bearing hinges; rudders horn-balanced and hinged on shrouded ball-bearings. Trim-tabs in port rudder and elevator; servo-tabs in starboard rudder and elevator.

LANDING GEAR.—Retractable tricycle type. Each main unit consists of levered suspension shock-absorber leg carrying two Dunlop wheels which retracts forward into inner engine nacelles and is enclosed by twin doors. Pneumatic operation. Dunlop pneumatic brakes on main wheels. Nose-wheel, of same size and interchangeable with main wheels, in telescopic half-fork unit with 9 in. (22.86 c/m.) travel, retracts forward into fuselage and is enclosed by twin doors. Rear bumper skid consists of rubber unit with metal sheath.

POWER PLANT.—Four D.H. Gipsy Queen 71 six-cylinder in-line inverted air-cooled engines with a cruising output (each) of 250 h.p. at 2,400 r.p.m., and with 330 h.p. available for take-off. Engine mountings of welded DTD 408 steel-tube with 12 Metalastic attachment points. Nacelles constructed similarly to fuselage. Electrically operated cooling flaps. De Havilland Hydromatic three-blade constant-speed full feathering airscrews. Four flexible fuel tanks each of 60 Imp. gallons (273 litres) capacity, two in each centre section.

ACCOMMODATION.—Crew of two; pilot and co-pilot/navigator side-by-side with dual controls. Co-pilot's seat and controls removable to allow permanent installation of navigator's table. Windscreen has duralumin tube frame with transparent Perspex panels. Aft of pilot's compartment is forward luggage compartment with capacity of 140 cub. ft. (3.96 cub. m.). Access hatch 2 ft. 6 in. (0.76 m.) square on port side of fuselage. Main cabin follows with capacity for 14-20 passengers or can be used solely for freight. Cabin is 18 ft. long × 7 ft. 9 in. wide × 6 ft. 2 in. high (mean height) (5.49 × 2.36 × 1.83 m.), capacity 774 cub. ft. (21.9 cub. m.). Cabin is air conditioned and thermostatically heat controlled. Inside temperature of 65° F. can be maintained when outside temperature is 15°F. Light luggage racks along sides of cabin. Entry door 5 ft. 4 in. × 2 ft. 6 in. (1.6 × 0.76 m.) on port side under wing trailing-edge. Cabin floor 2 ft. 5 in. (0.75 m.) from ground. Emergency escape hatch in roof. Rear luggage compartment aft of cabin with capacity of 165 cub. ft. (4.66 cub. m.). Loading hatch on starboard side 3 ft. 6 in. long × 3 ft. 1 in. high (1 m. × 0.94 m.).

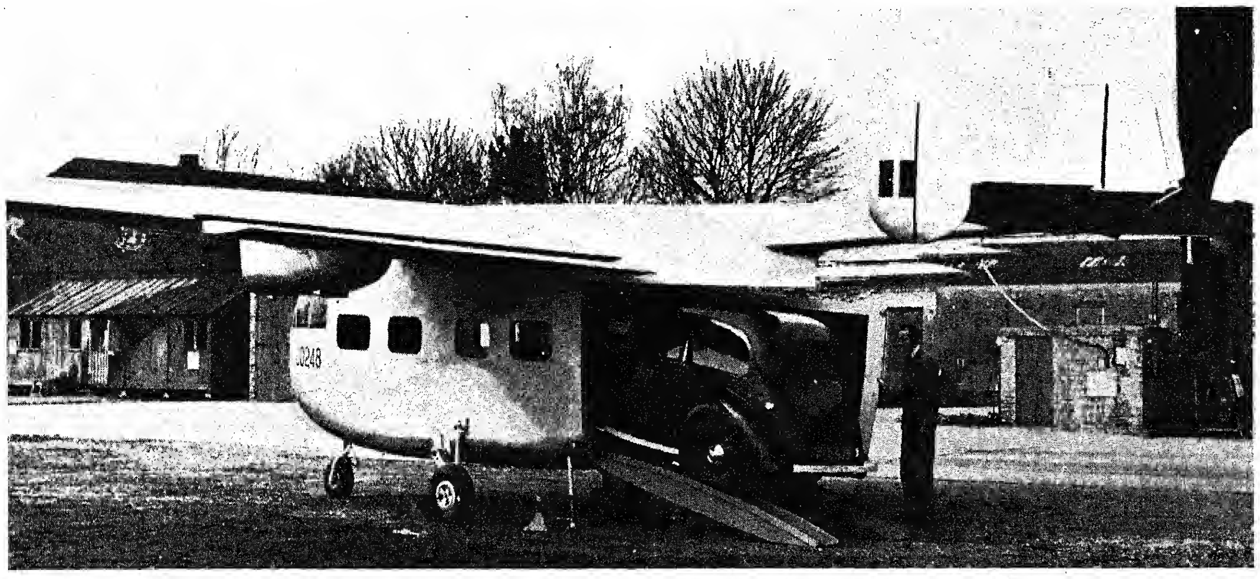
EQUIPMENT.—Radio behind navigator's seat. Provision for automatic pilot. T.K.S. de-icing. Pneumatic system powered by three 620 cub. in. (10,168 cub. c/m.) bottles with Heywood Hymatic compressors; normal pressure 450 lbs./sq. in. (31.6 kg./sq. c/m.) with maximum pressure of 600 lbs./sq. in. (35 kg./sq. c/m.). 24-volt D.C. electric system with two 1,000-watt generators.

DIMENSIONS.—Span 65 ft. 0 in. (19.81 m.), Length 52 ft. 1 in. (15.87 m.), Height 13 ft. 9 in. (4.19 m.).

WEIGHTS AND LOADINGS.—Weight empty (passenger aircraft) 11,460 lbs. (5,198 kg.), Weight empty (freighter) 10,690 lbs. (4,859 kg.), Crew (two) 350 lbs. (159 kg.), Total disposable load 5,040 lbs. (2,286 kg.), Weight loaded 16,500 lbs. (7,484 kg.), Wing loading (at loaded weight) 33 lbs./sq. ft. (161 kg./sq. m.), Power loading (at loaded weight, take-off power) 12.5 lbs./h.p. (5.65 kg./h.p.).

PERFORMANCE.—Maximum speed 230 m.p.h. (370 km.h.) at 6,300 ft. (2,745 m.), Economic cruising speed 175-200 m.p.h. (282-322 km.h.), Initial rate of climb 1,550 ft./min. (472 m./min.), Initial rate of climb on three engines 950 ft./min. (290 m./min.), Service ceiling 25,000 ft. (7,620 m.), Maximum still-air range 1,000 miles (1,609 km.), Take-off run (fully loaded, with flaps) 400 yds. (366 m.), Take-off distance to 50 ft. (15 m.) 600 yds. (550 m.).

***MILES**—continued.*



A four-seat car being driven into the fuselage of the Miles Aerovan Light Transport Monoplane.

THE MILES M-57 AEROVAN.

Type.—Light twin-engined Freight or Passenger monoplane.

Wings.—Cantilever high-wing monoplane. All-wood single-spar structure in three main sections consisting of centre-section carrying engine nacelles and two outer wings. Stressed plywood skin. Constant taper from root to tip. Wooden slotted ailerons with plywood skin, and Miles non-retractable auxiliary aerofoil flaps between ailerons and fuselage. Gross wing area 390 sq. ft. (36.23 sq. m.).

Fuselage.—Composite structure consisting of deep main body and tail boom. Main body enclosing pilot's compartment and main cabin is wooden structure of spruce and ply formers, longitudinal stringers and plywood covering. Floor of ply-faced low-density material. Tail boom of stressed light alloy construction extends aft from top of main body to carry tail unit.

Tail Unit.—Cantilever structure with three fins and horn-balanced rudders. Wooden framework with plywood covering over all surfaces. Trim-tab in central rudder and in each elevator.

Landing Gear.—Fixed tricycle type. Main wheels 7.5 × 10 carried on oleo-pneumatic articulated suspension units mounted directly on fuselage sides. Track 8 ft. 0 in. (2.44 m.). Steerable nose-wheel 6.0 × 6½ carried in fork on cantilever shock-absorber leg mounted under pilot's cabin. Medium-pressure tyres.

Power Plant.—Two 155 h.p. Blackburn Cirrus-Major four-cylinder in-line inverted air-cooled engines, or other engines of similar power and weight. Two-blade fixed-pitch wooden or constant-speed airscrews. Two flexible crash-proof fuel tanks, each with capacity of 24 Imp. gallons (109 litres) in wing root leading-edges with provision for additional tankage. 2½ Imp. gallon (11 litre) oil tank in each engine nacelle.

Accommodation.—Crew compartment in nose with pilot's seat on port, and seat on starboard side for additional member. Entry door on starboard side affords access to main cabin *via* further door in bulkhead aft of pilot's cabin. Moulded Perspex windscreen and side windows. Main cabin has floor length of 12 ft. 3 in. (3.73 m.), Width of 5 ft. 0 in. to 5 ft. 7 in. (1.52-1.7 m.) and height of 5 ft. 3 in. to 6 ft. 8 in. (1.59-1.03 m.), Volume 530 cub. ft. (15 cub. m.). Lashing points at frequent intervals in floor. Rear of main body hinged on starboard side to swing open beneath tail-boom to allow loading of freight. Rear door 5 ft. 5 in. high × 5 ft. 0 in. wide (1.64 × 1.52 m.). Floor 2 ft. (.61 m.) from ground. Special ramps can be provided to allow an automobile to be driven into cabin. Seats for up to nine passengers may be installed as alternative to freight. In six-passenger version toilet compartment installed in rear. For ambulance duties eight stretchers and one attendent can be accommodated. Cabin can also be arranged as operating theatre or for mail pick-up duties.

Dimensions.—Span 50 ft. 0 in. (15.24 m.), Length 36 ft. (10.96 m.), Height overall 13 ft. 6 in. (4.11 m.).

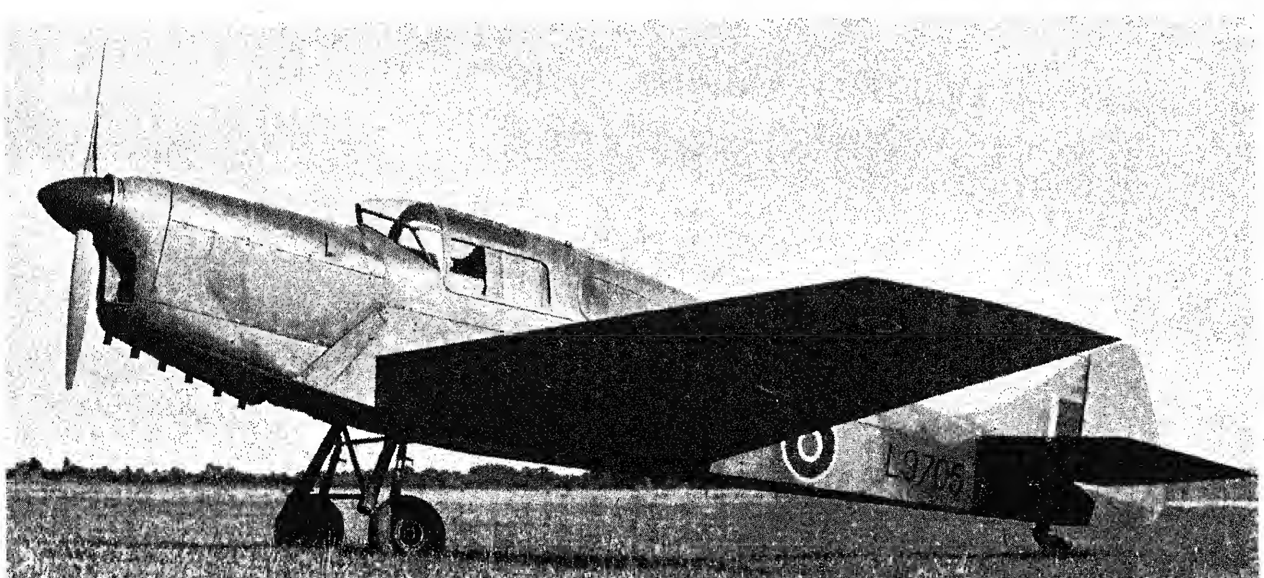
Weights and Loadings.—Weight empty 3,100 lbs. (1,406 kg.), Maximum payload 2,240 lbs. (1,018 kg.), Maximum weight loaded 5,800 lbs. (2,631 kg.), Wing loading (at 5,800 lbs.=2,631 kg.) 14.8 lbs./sq. ft. (72.26 kg./sq. m.), Power loading (at 5,800 lbs.= 2,631 kg.) 18.7 lbs./h.p. (8.46 kg./h.p.).

Performance.—Maximum speed 127 m.p.h. (204 km.h.) at sea level, Maximum cruising speed 110 m.p.h. (177 km.h.), Stalling speed 46 m.p.h. (75 km.h.), Initial rate of climb 620 ft./min. (189 m./min.), Service ceiling 13,250 ft. (4,040 m.), Normal still-air range 400 miles (644 km.), Take-off run in 5 m.p.h. (8 km.h.) wind 200 yds. (182 m.), Take-off distance to 50 ft. (15 m.) in 5 m.p.h. (8 km.h.) wind 350 yds. (320 m.).

THE MILES M-52.

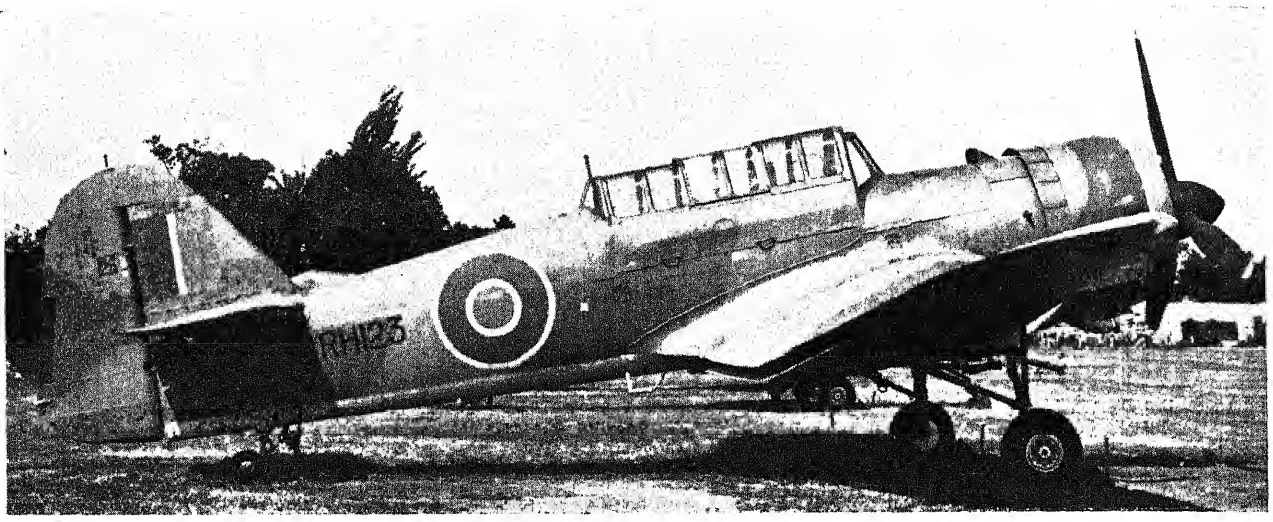
The M-52 was a projected jet-propelled aircraft specially designed for experimental flying at 1,000 m.p.h. (1,609 km.h.) at a height of 36,000 ft. (10,975 m.), which it could attain in 1½ minutes. Design work began in 1943 to an official order to Specification E.24/43, and by February, 1946, 90% of the detail design had been completed. For economic reasons, however, and because of modified policy relating to the general form of supersonic aircraft, the contract was cancelled.

The fuselage consisted of a bullet-shaped cylinder with a conical nose containing the pilot's pressurized cabin. Immediately aft of the cabin was the annular air intake for the engine,



A Miles Falcon-Six Monoplane fitted experimentally with the wing of the projected M-52 jet-propelled supersonic Monoplane.

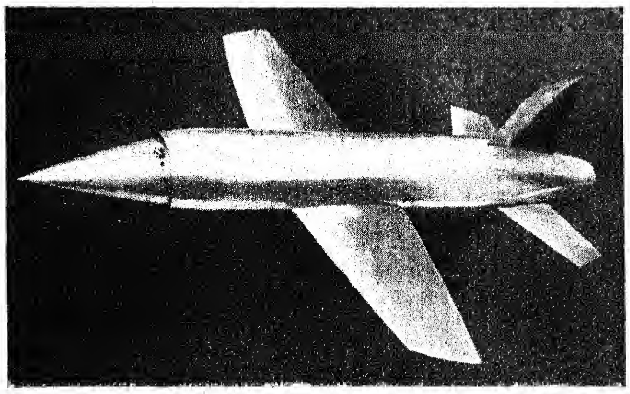
MILES—*continued.*



The Miles Queen Martinet Radio-Controlled Pilotless Target Monoplane (Bristol Mercury engine).

which exhausted from an aperture in the extreme tail. The mid-wing was a cantilever structure of bi-convex section with knife-sharp leading and trailing-edges. The monoplane tail unit consisted of swept-back surfaces of similar construction to the wing, the horizontal surfaces being arranged to move longitudinally. Dive recovery brakes 3 in. deep × 12 in. long (7.6 c/m. × 30.48 c/m.) were fitted under the wing.

The power unit was designed by Power Jets (Research and Development) Ltd. and consisted of a three-stage turbo-jet



A Model of the Miles M-52 Jet-propelled Supersonic Aircraft.

producing the equivalent of 17,000 h.p. It had a maximum diameter of 3 ft. 6 in. (1.07 m.) and was 23 ft. (7 m.) long, and occupied the greater part of the fuselage. The first stage consisted of an orthodox turbo-jet unit with centrifugal blower. From here the hot gases then flowed through a turbine, which also served as a ducted fan, the additional pure-air supply mixing with the stream, which was then ducted through an athodyd in which fuel was injected and burnt, thereby accelerating the flow and ejecting it from the nozzle in the tail.

The pilot's cabin was so designed that it could be jettisoned and lowered from the stratosphere by a parachute to a lower altitude, when the pilot could bale out in the usual manner. The jettison gear consisted of explosive-filled cleats on the main structural members to which the cabin was attached, which could be electrically detonated to release the cabin.

The landing gear of the M-52 was to be a tricycle structure with specially designed tyres and wheels. It was estimated that a landing run of 2 miles (3.22 km.) would be required, and that the touch-down speed would be in the neighbourhood of 170 m.p.h. (273 km.h.).

Before work began on the detail design of the M-52 a Miles Falcon-Six was fitted experimentally with the high-speed wing and tailplane to investigate their aerodynamic characteristics. After test flights had been made the basic form of the M-52 was settled and work on the mock-up proceeded.

Dimensions.—Span 27 ft. 0 in. (8.23 m.), Length 33 ft. 0 in. (10.05 m.), Wing area (approximate) 141 sq. ft. (13.09 sq. m.).

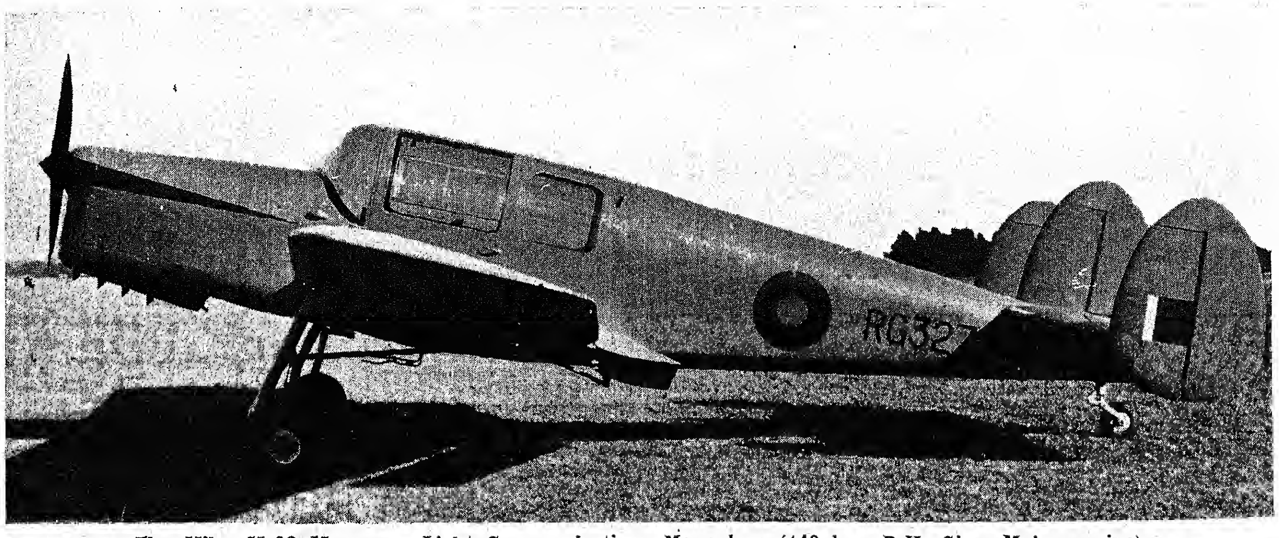
Weights and Loadings (Designed).—Weight loaded 8,200 lbs. (3,719 kg.), Wing loading 58 lbs./sq. ft. (283 kg./sq. m.).

THE MILES M-50 QUEEN MARTINET.

In 1942 Miles Aircraft was asked to consider the development of a radio-controlled aircraft to replace the D.H. Queen Bee biplane target. Two projects, the M-47 and the M-49, were tendered, but subsequently it was decided to use a standard Martinet converted as a target.

The Queen Martinet pilotless radio-controlled target aircraft is, except for the interior equipment, identical to the standard M-25 Target Tug. Conversion work began early in 1943, and by the end of 1945 43 Queen Martinets had been built.

The M-47 was to have been a low-wing monoplane using M-28 wings and tail-unit to promote speed in production, and to be powered by a cheaply-produced 220 h.p. engine.



The Miles M-38 Messenger Light Communications Monoplane (140 h.p. D.H. Gipsy-Major engine).

***MILES**—continued.*

The M-49 was projected as a small low-wing monoplane with a span of 21 ft. (6.4 m.) and designed to operate at 12,000 ft. (3,655 m.) at a speed of about 320 m.p.h. (515 km.h.) so as to provide an extremely difficult target for anti-aircraft gunners.

THE MILES M-38 MESSENGER.

The M-38 is a development of the M-28 and was converted during the war to meet the requirements of Specification 17/43 for use as an Air Observation Post by the Army. It was later adopted by the R.A.F. Basically the two types are structurally similar, but the M-38 incorporates several detail changes. A new wing of thinner aerofoil section, of slightly wider span and fitted with non-retractable Miles auxiliary flaps aft of the trailing-edge is used; the landing gear is of the fixed type, and a third central fin and rudder is added to give increased control at the low speeds at which the M-38 can operate. The prototype Messenger (which had in fact served as the prototype of the M-28) first flew on September 12, 1942.

The Messenger has since been made available for civilian use and at the time of writing was in full production. It is available as a private owner's aircraft; as an air-taxi; an ambulance, or as a light freight carrier.

TYPE.—Four-seat cabin monoplane.

WINGS AND FUSELAGE.—Structure as M-65 Gemini.

TAIL UNIT.—As Gemini, except that third central fin and rudder added.

LANDING GEAR.—Fixed two-wheel type. Main wheels each carried on Miles oleo-pneumatic articulated suspension shock-absorber leg. Track 9 ft. 11 in. (3.02 m.). Bendix brakes on main wheels. Self-centering tail-wheel carried on oleo-sprung articulated unit.

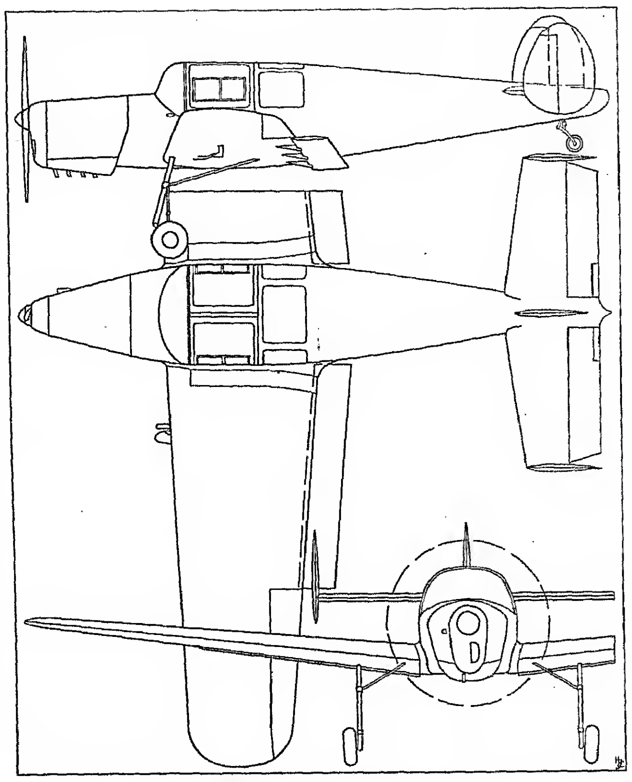
POWER PLANT.—One 155 h.p. Blackburn Cirrus-Major III four-cylinder in-line inverted air-cooled engine driving two-blade fixed-pitch wooden airscrew, 6 ft. 6 in. (1.98 m.) diameter. Two flexible fuel tanks, one in each wing, with total capacity of 36 Imperial gallons (164 litres). Oil capacity $2\frac{1}{2}$ Imp. gallons (11 litres).

ACCOMMODATION.—As Gemini.

DIMENSIONS.—Span 36 ft. 2 in. (11.02 m.), Length (tail-up) 24 ft. (7.32 m.), Height (tail down, over cabin) 7 ft. 6 in. (2.29 m.).

WEIGHTS AND LOADINGS.—Weight empty (with standard equipment), 1,438 lbs. (652 kg.), Maximum weight loaded 2,400 lbs. (1,088 kg.), Wing loading (at 2,400 lbs.=1,088 kg.) 12.5 lbs./sq. ft. (61 kg./sq. m.), Power loading (at 2,400 lbs.=1,088 kg.) 15.4 lbs./h.p. (6.9 kg./h.p.).

PERFORMANCE.—Maximum speed 135 m.p.h. (217 km.h.), Maximum cruising speed 124 m.p.h. (200 km.h.), Stalling speed at sea level 25 m.p.h. (40 km.h.), Initial rate of climb 950 ft./min. (289 m./min.), Service ceiling 16,000 ft. (4,875 m.), Still air range 460 miles (740 km.), Take-off run in 5 m.p.h. (8 km.h.) wind, 75 yds. (68.5 m.), Take-off distance to 50 ft. (15 m.) 200 yds. (183 m.), Landing run in 5 m.p.h. (8 km.h.) wind, 80 yds. (73 m.).



The Miles M-38 Messenger.

THE MILES M-37 MARTINET TRAINER.

The M-37 is a conversion from the Martinet and has been developed for advanced training duties. This aircraft was originally conceived some years ago as a further variation of the Master, in which the instructor in the rear cockpit is situated in a permanently raised position, instead of having to raise his seat for take-off and landing as in the Master. The prototype M-37 made its first flight on April 11, 1946. Performance figures were not available for publication at the time of writing.

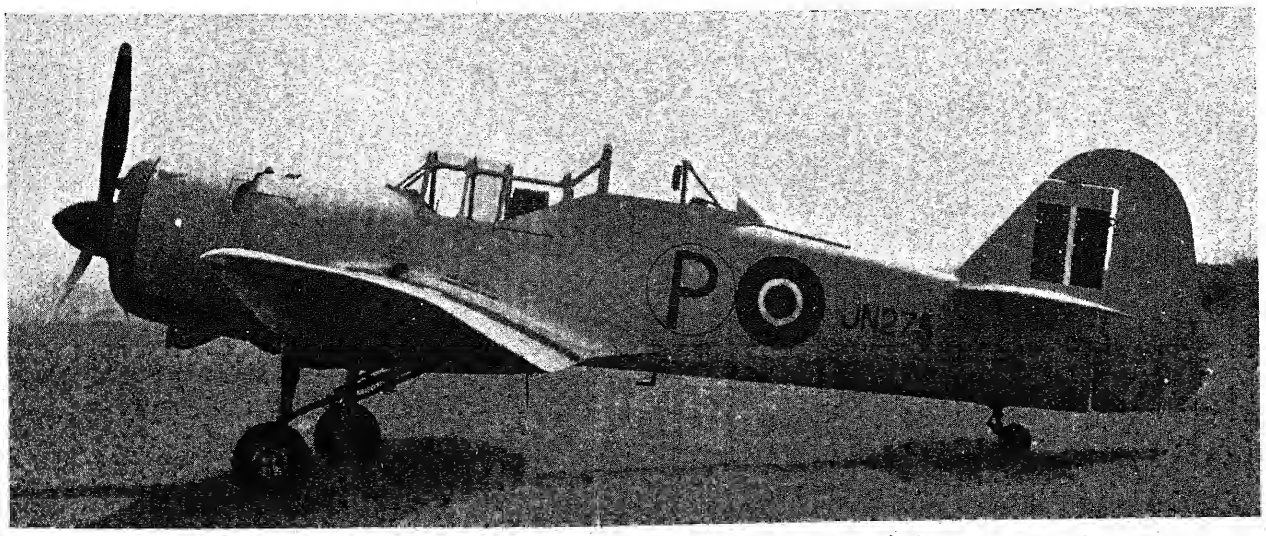
THE MILES M-33 MONITOR.

The Monitor was designed to Specification Q.9/42 to meet requirements for a high-speed target-tug which would have a towing speed of not less than 300 m.p.h. (483 km.h.) and an endurance of 3-4 hours. The prototype T.T.Mk.I first flew on April 5, 1944, and proved to be eminently satisfactory, the maximum speed being 360 m.p.h. (576 km.h.). As naval requirements for such an aeroplane, and particularly one which could simulate dive-bombing attacks on ships, were urgent the R.A.F. relinquished its claim to the Monitor, which was then put into production for the Royal Navy as T.T.Mk.II, with certain modifications, including hydraulically-operated dive-brakes, to suit it to its new duties. The Mk. II is intended primarily for high-speed Fleet target-towing duties.

TYPE.—Twin-engined Target-Tug.

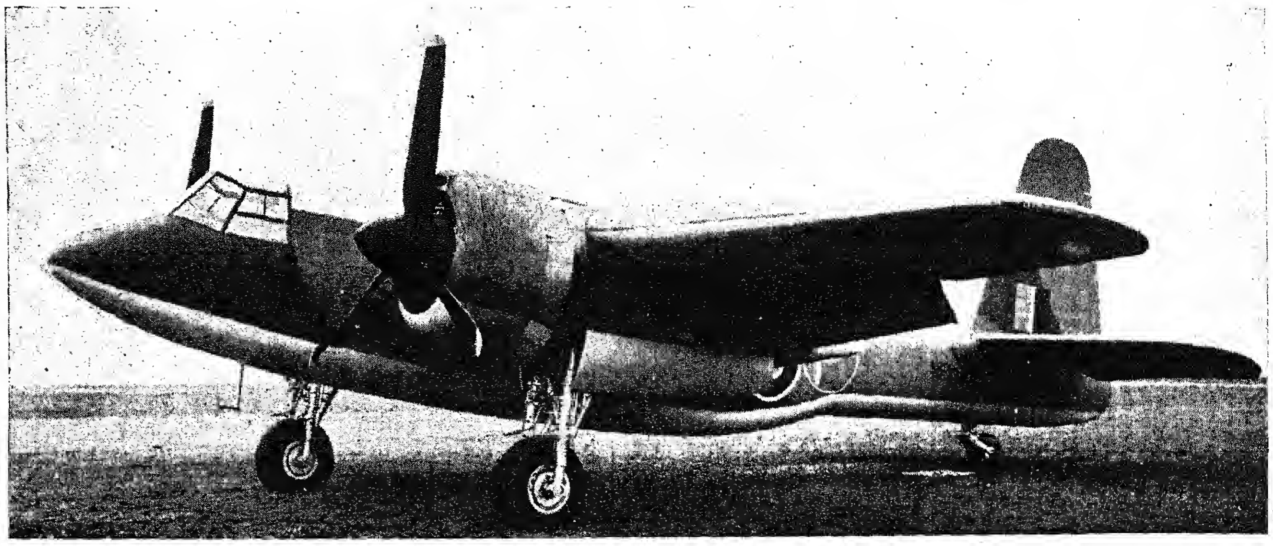
WINGS.—Wooden cantilever high-wing monoplane. Aerofoil section (root) NACA 23021; (tip) NACA 2412. Two-spar one-piece structure, tapering in chord and thickness outboard of nacelles. Wooden laminated spars and ribs and stressed plywood skin. Incidence (6 ft. $4\frac{1}{2}$ in.=1.94 m. from fuselage centre-line) $1\frac{1}{2}°$, dihedral (commencing 19 ft. 4 in.=5.89 m. from fuselage centre-line) 1°. Root chord 10 ft. 9 in. (3.27 m.), projected tip chord 5 ft. $11\frac{5}{8}$ in. (1.82 m.). Gross wing area 501.48 sq. ft. (46.58 sq.m.) Aspect ratio 6 : 1. Wooden ailerons have plywood covering and inset trim and balance-tabs. Aileron area (each, excluding tabs) 34.14 sq. ft. (3.17 sq. m.), trim-tab area (each) 1.95 sq. ft. (.18 sq. m.), balance tab area (each) 1.95 sq. ft. (.18 sq. m.). Wooden slotted trailing-edge flaps between ailerons and fuselage, divided by nacelles. Hydraulic operation. Total flap area 50.2 sq. ft. (4.66 sq. m.). Dive-brakes (on some Mk. II aircraft) on top and bottom surfaces of wing each travel through 90°.

FUSELAGE.—All-metal structure in five main pieces, with stressed metal skin. Maximum width 4 ft. 6 in. (1.37 m.), Maximum depth 6 ft. 5 in. (1.95 m.). Fuselage datum to thrust line 1 degree 3 minutes.



The Miles M-37 Martinet Trainer (Bristol Mercury engine).

MILES*—continued.*



The Miles Monitor High-speed Target-tug (two Wright R-2600-31 engines).

TAIL UNIT.—Cantilever monoplane type. Aerofoil Section NACA 0012. All-metal structure with stressed metal skin over fixed and movable surfaces. Incidence (positive to fuselage datum) 30 minutes. Tailplane span 22 ft. 9 in. (6.93 m.), Root chord (including elevator 6 ft. 6 in. (1.98 m.), Projected tip chord 4 ft. 10¾ in. (1.5 m.). Tailplane area (excluding elevators) 81.5 sq. ft. (7.57 sq. m.), Elevators (both, excluding tabs) 41.4 sq. ft. (3.84 sq. m.), Trim-tab (each) 1.25 sq. ft. (4.11 sq. m.), Balance tabs (each) 2.55 sq. ft. (.23 sq. m.). Horn-balanced rudder of Dickerman 12% aerofoil section. Fin area 24 sq. ft. (2.23 sq. m.), Rudder (excluding tabs) 20 sq. ft. (1.85 sq. m.), Rudder trim-tab 2 sq. ft. (.18 sq. m.), Rudder balance tab 3 sq. ft. (.27 sq. m.).

LANDING GEAR.—Retractable two-wheel type, based on Bristol Beaufighter units. Each unit consists of twin Lockheed oleo-pneumatic shock-absorber legs which retract backwards into engine nacelles and are enclosed by twin-doors. Hydraulic operation. Dunlop 37 × 13.00-15 tyres with pressure of 48 lbs./sq. in. (3.37 kg/sq. c/m.). Track 18 ft. 0 in. (5.45 m.). Self-centring tail-wheel carried in fork on B.L.G. shock-absorber strut retracts forward into fuselage and is enclosed by twin doors. 9.00 × 5¼ Dunlop tyre with pressure of 34 lbs./sq. in. (2.39 kg./sq. c/m.).

POWER PLANT.—Two 1,750 h.p. Wright Cyclone R-2600-31 fourteen-cylinder two-row radial air-cooled engines driving Hamilton Standard Hydromatic A.5/115 or A.5/155 three-blade metal constant-speed full-feathering airscrews, 12 ft. 6 in. (3.81 m.) diameter, right-hand rotation. Pitch settings 18 degrees; 24 degrees and 89 degrees. 3RD/1 metal spinners. Two fuel tanks of 170 Imp. gallons (773 litres) capacity in wing inboard of engines, and one centre-section tank of 140 Imp. gallons (636 litres) capacity. Total capacity 480 Imp. gallons (2,182 litres). One inter-spar oil tank of 14 Imp. gallons (63.6 litres) capacity in each nacelle plus 7 Imp. gallons (31.8 litres) air space.

ACCOMMODATION.—Crew of two consisting of pilot in forward enclosed cockpit and observer/target-operator in middle section of fuselage, with Perspex dorsal cupola for observation purposes, and hatch in underside of fuselage for automatic ejection of targets.

EQUIPMENT.—Miles 10 h.p. hydraulic winch installed in fuselage, driven from starboard engine, allows operation of targets at more than 300 m.p.h. (483 km.h.). Target placed on endless conveyor belt and discharged from underside of fuselage. Accommodation for horizontal or vertical flag or drogue targets. Locker for four flags on port side of fuselage. Winged glider targets of 16 ft. 0 in. (4.87 m.) and 32 ft. 0 in. (9.75 m.) span can also be towed. Total weight of towing gear 660 lbs. (299 kg.). Cable prevented from fouling tail-unit by safety wire extending from underside of fuselage to tips of tailplane and rudder. Ciné-cameras in observer's manually-operated dorsal cupola and in nose for marking gunnery practices on targets. Full radio equipment, and radar height checking apparatus. 24-volt electric system.

DIMENSIONS.—Span 55 ft. 3 in. (16.84 m.), Length 48 ft. 8 in. (14.83 m.), Height (tail up) 18 ft. 4 in. (5.58 m.), Height (tail down, one airscrew blade vertically upwards) 14 ft. 3 in. (4.34 m.).

WEIGHTS AND LOADINGS.—Weight empty 15,723 lbs. (7,132 kg.), Fuel and oil 3,744 lbs. (1,698 kg.), Weight loaded 21,056 lbs. (9,551 kg.), Wing loading (fully loaded) 42 lbs./sq. ft. (205 kg./sq. m.), Power loading (fully loaded) 6 lbs./h.p. (2.7 kg./h.p.).

PERFORMANCE.—Maximum speed 360 m.p.h. (579 km.h.), Cruising speed (with target) 300 m.p.h. (483 km.h.) at 20,000 ft. (6,095 m.) Stalling speed 90 m.p.h. (144 km.h.), Climb to 12,500 ft. (3,810 m.) 5 minutes.

THE MILES M-28.

The M-28 is a four-seat low-wing cabin monoplane from which the M-38 Messenger was developed. It was conceived originally in 1939 as a replacement type for the civil M-11 Whitney Straight and M-17 Monarch monoplanes, but development was dropped on the outbreak of war. The design was revived in 1941 for use as a military training and communications monoplane, and the prototype M-28 made its first flight on July 11, 1941.

The following versions were built in prototype form:—

M-28-1. Two-seat dual control trainer with D.H. Gipsy Major IIA engine and fixed-pitch airscrew. Mechanically-operated landing-gear and vacuum-operated flaps.

M-28-2. Three-seat dual-control trainer with D.H. Gipsy Major or Blackburn Cirrus Major engine. Hydraulically-operated landing-gear.

M-28-3. Three-seat triple-control trainer with Blackburn Cirrus Major III engine. Vacuum-operated landing-gear, flaps and air-brake. Modified wing with constant taper from roots.

M-28-4. Four-seat light transport or communications aircraft. D.H. Gipsy-Major or Blackburn Cirrus-Major engine. Single-control. Vacuum-operated landing-gear, flaps and air-brake. This version, once known as the Mercury, has since been made

The Miles M-28-4 Four-seat Cabin Monoplane (Blackburn Cirrus-Major III engine).

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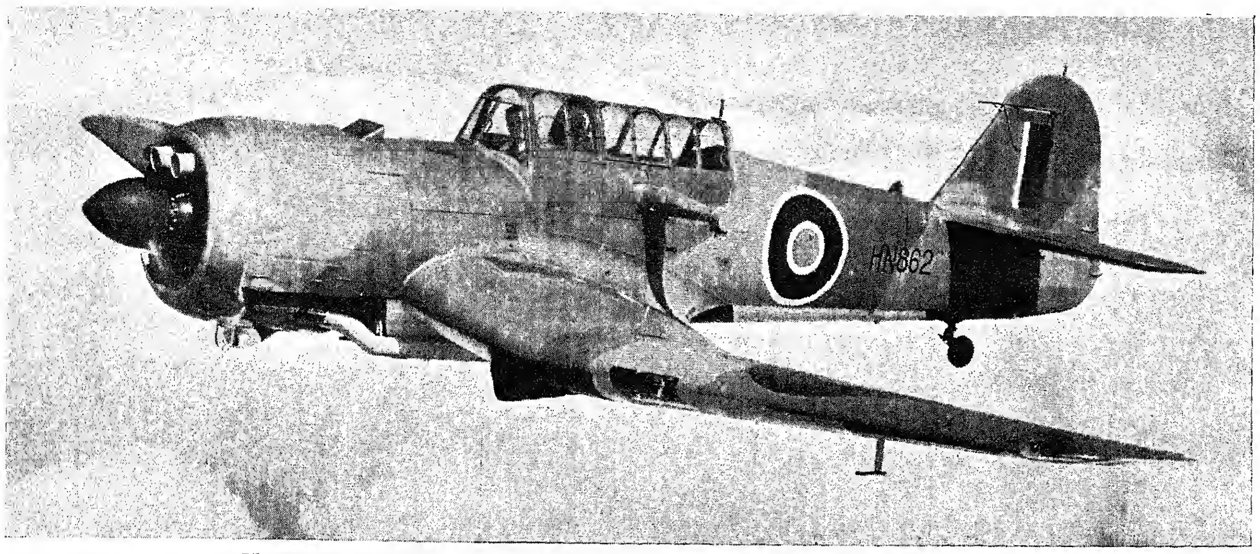


The Miles M-25 Martinet Target-towing Monoplane (Bristol Mercury engine).

available for civilian duties and the following specification applies to this model.

Type.—Four-seat cabin monoplane.

Wings.—Structure as M-38 Messenger. Retractable Miles flaps. Wing area 160 sq. ft. (14.86 sq. m.).

Fuselage.—Structure as M-38 Messenger.

Tail Unit.—Same as for M-38 Messenger, but without central fin and rudder.

Landing Gear.—Retractable type. Each main unit comprises a fork incorporating knee-action oleo-pneumatic shock-absorbers and a small-diameter medium-pressure wheel. Wheels retract backwards into wing. Bendix wheel-brakes. Levered-suspension oleo-pneumatic tail-wheel. Track 10 ft. (3.05 m.).

Power Plant.—Any four-cylinder in-line engine of about 150 h.p. may be fitted, including the D.H. Gipsy-Major IIA with fixed-pitch airscrew; the D.H. Gipsy-Major III or IIIS with D.H. constant-speed airscrew; or the Cirrus Major III with Fairey-Reed metal airscrew. Main fuel tanks in wings with capacity of 24 Imp. gallons (109 litres). Oil capacity 3 Imp. gallons (13.6 litres).

Accommodation.—Enclosed cabin seating three or four. Large clear-view windscreen provides unrestricted view forward on both sides of nose. Sides of cabin hinge upward to give access. Cabin can be adapted for a number of specialised applications.

Dimensions.—Span 30 ft. 8 in. (9.35 m.), Length 24 ft. (7.32 m.), Height (tail down—over cabin) 8 ft. 4 in. (2.54 m.).

Weights and Loadings.—Weight empty 1,460 lbs. (663 kg.), Disposable load 1,440 lbs. (653 kg.), Weight loaded 2,500 lbs. (1,134 kg.), Wing loading 15.6 lbs./sq. ft. (76 kg./sq. m.).

Performance (Gipsy-Major IIIS with c/s airscrew and at loaded weight of 2,400 lbs. = 1,090 kg.).—Maximum speed 180 m.p.h. (288 km.h.) at 7,000 ft. (2,135 m.), Cruising speed 169 m.p.h. (270.4 km.h.) at 6,400 ft. (1,950 m.), Stalling speed 46 m.p.h. (73.6 km.h.), Initial rate of climb 1,080 ft./min. (330 m./min.), Range 480 miles (770 km.).

THE MILES M-25 MARTINET.

The Martinet is a variation of the Master and was produced as an interim type for target-towing duties until the arrival of a faster type. It is essentially a Master, but has a re-designed cockpit enclosure and carries a wind-driven winch in the rear cockpit. The prototype Martinet first flew on April 24, 1942, and altogether 1,574 were built up to the end of 1945.

For glider-towing duties the Martinet appeared with a small portion of the rudder cut away to allow for the insertion of a towing hook and cable, similarly to the Master Glider-Tug. The target-towing winch was removed but otherwise this version did not differ from the standard M-25.

Type.—Two-seat Target-tug.

Wings.—Cantilever low-wing monoplane. Aerofoil section Modified NACA 23024. Wooden structure in three main sections; centre-section set at acute anhedral angle and two tapered outer sections with dihedral angle. Spars are parallel in centre-section, front spar passing through fuselage; rear spar swept forward in outer wings. Spars of box-section with laminated spruce flanges and 5-ply webs, and high-tensile fittings. Stressed Saro laminated plywood covering, over which is covering of madapolam fabric. Wooden ailerons with plywood covering. Miles hydraulically operated split trailing-edge flaps in two sections each side extend from ailerons to centre-line of fuselage. Depression 25 degrees for take-off; 90 degrees for landing. Gross wing area 238 sq. ft. (2.1 sq. m.).

Fuselage.—Wooden semi-monocoque structure of oval cross-section with four spruce longerons, transversal frames and longitudinal stringers. Stressed plywood skin.

Tail Unit.—Cantilever monoplane type. Wooden structure with plywood covering to fin, tailplane and elevators. Horn-balanced rudder has fabric covering. Trim-tabs in rudder and elevators. Tailplane span 13 ft. 9 in. (4.19 m.).

Landing Gear.—Retractable two-wheel type. Each main wheel carried on oleo-pneumatic shock-absorber strut which retracts backwards and turns through 90 degrees so that wheel lies flush with underside of centre-section. Hydraulic operation and hydraulic brakes on main wheels. Track 12 ft. 9 in. (3.89 m.). Non-retractable full-castering tail-wheel. Complete landing gear identical to and interchangeable with all marks of Master.

Power Plant.—One Bristol Mercury XX or 30 nine-cylinder radial air-cooled engine rated at 835/870 h.p. at 4,500 ft. (1,370 m.) and 785/820 h.p. at sea level. NACA cowling with leading-edge exhaust collector ring and trailing-edge controllable gills. Three-blade airscrew. Main fuel tanks in centre-section and auxiliary tanks in outer wings. Oil tank in fuselage behind fireproof bulkhead.

Accommodation.—Enclosed accommodation for two in tandem. The observer occupies the after position. Wind-driven winch for sleeve or flag targets, or electric winch for sleeve target only. Flag targets released from container under fuselage by cockpit control. Sleeve targets stowed in rear cockpit with halyards for attachment to flag target tow-line. Provision is made for the observer to gain access to the end of the winch cable through a hatch in the bottom of the cockpit. A tip-up seat is provided for the observer.

Dimensions.—Span 39 ft. (11.9 m.), Length 30 ft. 11 in. (9.45 m.), Height 11 ft. 7 in. (3.57 m.).

Weights and Loadings.—Weight empty 4,600 lbs. (2,090 kg.), Weight loaded 6,600 lbs. (3,000 kg.), Wing loading 27.7 lbs./sq. ft. (135 kg./sq. m.).

Performance.—Maximum speed at sea level 232 m.p.h. (371 km.h.), Speed at 15,000 ft. (4,575 m.) 237 m.p.h. (379 km.h.), Cruising speed at 4,500 ft. (1,370 m.) 225 m.p.h. (360 km.h.).

PERCIVAL.

PERCIVAL AIRCRAFT, LTD.

Head Office and Works: Luton Airport, Luton, Bedfordshire.

Directors: P. Ll. Hunting (Chairman), Wing Cdr. G. L. Hunting, Capt. C. P. Hunting, W. A. Summers, K. D. Morgan, N. R. Whiteside and R. R. S. Cook.

Chief Designer: A. A. Bage, A.F.R.Ae.S.

Works Manager: W. E. Salmon.

The Percival Aircraft Company was formed in 1932. It was re-organized as Percival Aircraft Ltd. in 1937, and the works were moved from Gravesend to Luton. A branch office was opened at Toronto, Canada, early in 1946.

Percival aircraft achieved a number of outstanding performances in the years before the war, details of which have been given in previous issues of this Annual.

Before the War the Percival Vega Gull had been chosen by the Air Ministry for conversion to service use. Officially named the Proctor it has been, and still is, serving as a trainer and as a light communications type. It is in use as a navigational and radio trainer by the R.A.F. and the Royal Navy. It is also serving as a dual control trainer and as a four seat liaison and communications monoplane.

The latest version is the Proctor V, which is a civil version of the Mk. IV and is described below. The Proctor VI will have a D.H. Gipsy Queen 31 engine. Details of the Prentice trainer and the Merganser twin-engined commercial monoplane also follow.

THE PERCIVAL PROCTOR V.

Type.—Four-seat Cabin monoplane.

Wings.—Low-wing cantilever monoplane. Wing in three sections, a rectangular centre-section and two tapering outer sections. Centre-section located in recess in bottom of fuselage and attached by four bolts. Outer sections hinged at rear spar joints, the portions of the wings aft of rear spars and inboard of ailerons hinging upwards to permit folding. Structure consists of two wooden box

PERCIVAL—*continued.*

spars connected at intervals by bulkheads and spruce diagonal bracing members, former ribs, plywood leading-edge and a fabric covering. Gross wing area 202 sq. ft. (18.76 sq. m.). Manually-operated all-wood three-position split trailing-edge flaps between ailerons and fuselage.

Fuselage.—Rectangular structure with domed top and bottom built up of four spruce longerons, plywood sides and a pre-formed ply bottom skin. Top decking is plywood over laminated spruce frames. Complete structure fabric-covered.

Tail Unit.—Cantilever monoplane type. Tailplane and fin built up of two wood box-spars, ribs and plywood covering. Elevators and rudder have single box-spar, spruce and plywood ribs and fabric covering. Trimming-tabs in elevators and rudder operated from cockpit through reversible units on the spars.

Landing Gear.—Fixed cantilever type. Each unit consists of a cantilever compression leg, incorporating double steel springs and a hydraulic recoil damper, attached to the centre-section front spar by four bolts. Streamline fairing to leg merges into wheel fairing. Medium-pressure wheels and Bendix mechanical brakes. Track 8 ft. 9 in. (2.97 m.). Full swivelling and self-centering tail-wheel.

Power Plant.—One 208 h.p. D.H. Gipsy Queen II six-cylinder inverted air-cooled engine on steel-tube mounting. D.H. constant-speed airscrew. Two fuel tanks (40 Imp. gallons = 182 litres total capacity), one in root of each outer wing section and feeding to three-way cock in the cabin. Oil tank (3.8 Imp. gallons = 17 litres) in leading-edge of centre-section on port side. Oil cooler at inboard end of tank and faired into centre-section with outlet flap adjustable on the ground. Vacuum pump on engine for operation of blind-flying instruments. Large generator with flexible drive from engine.

Accommodation.—Enclosed cabin with two seats side-by-side in front with optional dual controls and a full-width seat with folding central arm-rest across back of cabin. Single shock-proof panel includes full blind-flying and night-flying instruments, landing and navigation lights, cabin and instrument lighting and there is provision for radio. Luggage space aft of rear seats and there is a small additional locker aft.

Dimensions.—Span 39 ft. 6 in. (12 m.), Width folded 16 ft. 4 in. (4.98 m.), Length 28 ft. 2 in. (8.6 m.), Height (tail down) 7 ft. 3 in. (2.21 m.).

Weights and Loadings (Standard aircraft).—Weight empty (fully equipped 2,450 lbs. (1,111 kg.), Fuel 290 lbs. (123 kg.), Oil 36 lbs. (16 kg.), Pilot 170 lbs. (77 kg.), Three passengers 510 lbs. (231 kg.), Luggage 44 lbs. (20 kg.), Payload (passengers and luggage) 554 lbs. (251 kg.), Weight loaded 3,500 lbs. (1,587 kg.), Wing loading 17.32 lbs./sq. ft. (84.56 kg./sq. m.), Power loading 16.8 lbs./h.p. (7.61 kg./h.p.).

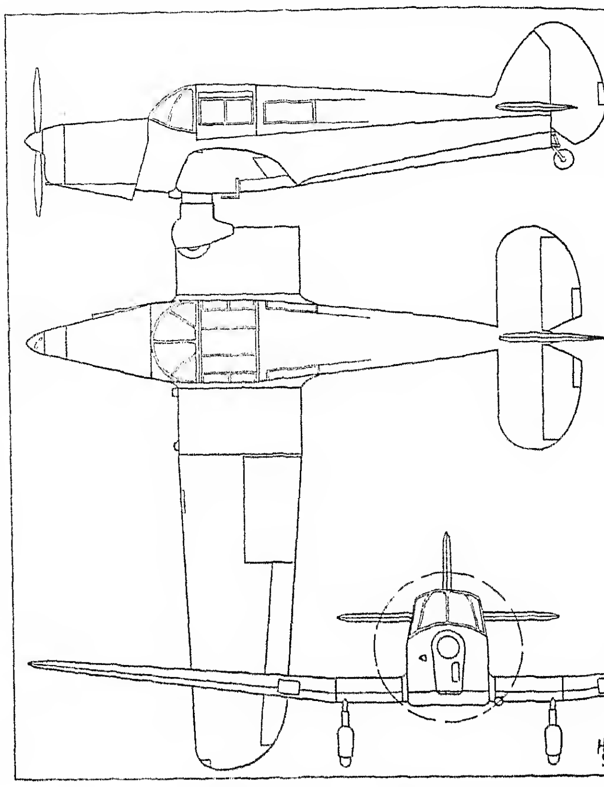
Weights (Standard aircraft with extra payload).—Weight empty (fully equipped) 2,450 lbs. (1,111 kg.), Fuel 145 lbs. (66 kg.), Oil 18 lbs. (8 kg.), Pilot 170 lbs. (77 kg.), Three passengers 510 lbs. (231 kg.), Luggage 207 lbs. (94 kg.), Payload (passengers and luggage) 717 lbs. (325 kg.), Weight loaded 3,500 lbs. (1,587 kg.).

Weights (Long-range aircraft).—Weight empty 2,500 lbs. (1,135 kg.), Fuel 435 lbs. (197 kg.), Oil 47 lbs. (21 kg.), Pilot 170 lbs. (77 kg.), Two passengers 340 lbs. (154 kg.), Luggage 8 lbs. (4 kg.), Payload (passengers and luggage) 348 lbs. (158 kg.), Weight loaded 3,500 lbs. (1,587 kg.).

Performance (Standard aircraft).—Maximum speed 157 m.p.h. (253 km.h.) at sea level, Maximum economical cruising speed 146 m.p.h. (235 km.h.) at 6,000 ft. (1,830 m.), Economic cruising speed at 3,000 ft. (915 m.) 140 m.p.h. (235 km.h.), Economic cruising speed at sea level 135 m.p.h. (217 km.h.), stalling speed (flaps down) 55 m.p.h. (88 km.h.), rate of climb 680 ft./min. (207 m./min.), Service ceiling (approximate) 14,000 ft. (4,250 m.), Range (allowing ¼ hour at full throttle) 500 miles (805 km.), Take-off at sea-level in 5 m.p.h. (8 km.h.) wind, from grass 290 yds. (265 m.), from concrete 250 yds. (229 m.), Take-off distance to 50 ft. (15 m.) from grass 660 yds. (603 m.), from concrete 620 yds. (567 m.), Economic cruising petrol consumption 10 Imp. gallons per hour (45 litres per hour).

Performance (Standard aircraft with extra payload).—Range 260 miles (418 km.).

Performance (Long-range aircraft, with 60 Imp. gallons (273 litres) fuel and 5¼ Imp. gallons (24 litres) oil).—Range (allowing ¼ hour at full throttle) 780 miles (1,255 km.).



The Percival Proctor V.

The Proctor has been supplied to the R.A.F. and the Royal Navy for training and communications work in the following forms:—

Proctor I. R.A.F. and A.T.A. communications type. Three-seater with side-by-side dual control and one rear seat.

Proctor I. Naval, Radio and Navigational Trainer. Three-seater with radio-operator on rotatable rear seat. D/F loop aerial on top of cabin.

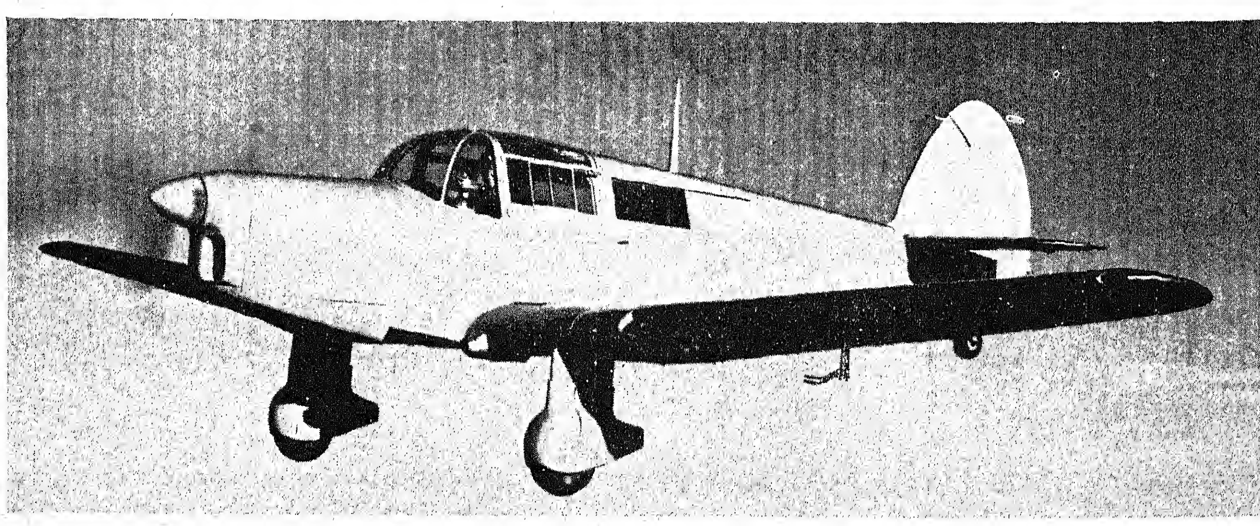
Proctor II. Naval Radio and Navigational Trainer. Three-seater with radio operator beside pilot. D/F loop aerial on top of cabin.

Proctor III. R.A.F. communications type. Three-seater. No dual control. Another version of Mark III has the rear seat on the port side with a small radio set alongside.

Proctor III, Series 2. R.A.F. Radio Trainer. Two-seater with radio-operator seated beside pilot and facing aft. D/F loop on top of cabin.

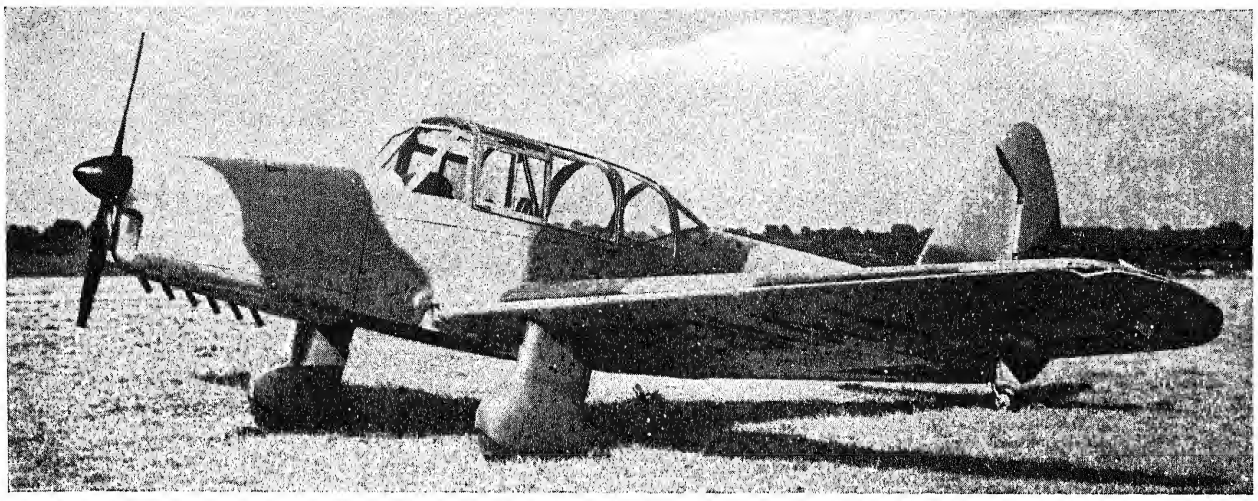
Proctor IV. R.A.F. Radio Trainer. A larger, heavier and completely re-designed Proctor which is fully equipped for night flying and carries the largest type of radio transmitter and receiver as used on operational aircraft. Three-seater with radio-operator beside pilot. D/F loop on top of cabin.

Proctor IV. R.A.F. Communications type. Four-seater with dual control and two rear seats.



The Percival Proctor V Four-seat Cabin Monoplane (208 h.p. D.H. Gipsy Queen II engine).

***PERCIVAL**—continued.*



The Percival Prentice Tnree-seat Primary Training Monoplane (D.H. Gipsy Queen engine).

The following particulars relate to the Proctor IV :—

Type.—Three-seat Radio Trainer or Four-seat Communications monoplane.

Wings, Fuselage, Tail Unit, Landing Gear and Power Plant.—Same as for Proctor V.

Accommodation (Radio Trainer).—Pilot on port side, radio operator further back on starboard side with radio transmitter and receiver in front of him, second radio-operator (who can change places with first operator) in seat at rear of cabin. Fixed and trailing aerials and D/F loop aerial, as well as intercommunication telephones for each member of the crew. A signalling lamp and complete night-flying equipment are installed. Air conditioning is provided by a controllable fresh air inlet and sliding windows.

Accommodation (Communications).—Two pilots in front, each seat mounted on a standard seat bearer and control unit which can be removed or replaced in a few hours. Two seats side-by-side at back of cabin with room for light luggage behind the seats.

Dimensions.—Same as Proctor V.

Weights and Loadings.—Weight empty (with full equipment) 2,370 lbs. (1,076 kg.), Disposable load 1,130 lbs. (513 kg.), Weight loaded (max. permissible) 3,500 lbs. (1,589 kg.), Wing loading 17.3 lbs./sq. ft. (84.42 kg./sq. m.), Power loading 16.8 lbs./h.p (7.62 kg./h.p.).

Performance (at max. permissible load).—Maximum speed at sea level 160 m.p.h. (256 km.h.), Maximum cruising speed 148 m.p.h. (237 km.h.), Economical cruising speed (at sea level) 135 m.p.h. 217 km.h.), Economical cruising speed at 6,000 ft. (1,830 m.) 146 m.p.h. (235 km.h.), Stalling speed (flaps down) 55 m.p.h. (88 km.h.). Initial rate of climb 700 ft./min. (213.5 m./min.), Climb to 5,000 ft. (1,525 m.) 9 mins., Ceiling 14,000 ft. (4,270 m.), Range in still air (after allowing for ½ hour at full throttle) 500 miles (805 km.), Take-off run in still air (from grass) 325 yds. (297 m.), Take-off run in still air (from runway) 285 yds. (261 m.).

THE PERCIVAL PRENTICE.

The Prentice three-seat trainer was designed to Specification T.23/43. Dual controls are fitted for the instructor and one pupil side-by-side in front. A third seat is installed behind for a second pupil, who is carried solely for the purpose of gaining air experience and who is equipped with an electrical intercom. so that he can listen in to the instructor's commentary.

The Prentice may be fitted with either the 251 h.p. D.H. Gipsy Queen 32 or the 296 h.p. Gipsy Queen 51 engine. It is in production by Percival Aircraft, and at the time of writing plans were being completed for its production by Blackburn Aircraft, Ltd. at Brough.

Type.—Three-seat Primary Training monoplane.

Wings.—All-metal cantilever low-wing monoplane. Two-spar structure built in two sections attached direct to fuselage. Detachable wing-tips. Spars have light extruded flanges and reinforced plate webs. Leading and trailing-edge portions made up as complete units. Full-depth pressed light alloy ribs approximately 20 in. (50.8 c/m.) apart with three light former ribs top and bottom between. Light alloy sheet covering. Reinforced root has spanwise stringers to form walkway. Wing area 305 sq. ft. (28.33 sq. m.). Ailerons have light alloy D-spar, pressed sheet ribs and fabric covering. Trim-tab in port aileron adjustable on ground only. Pneumatically-operated split trailing-edge flaps in three sections between ailerons. Safety device prevents immediate retraction of flaps after baulked landing.

Fuselage.—All-metal structure in two portions, front portion of rectangular section to aft of cockpit, and rear portion of flattened elliptical section. Front portion has sides and bottom built up as semi-braced structure with light alloy sheet covering. Two built-up girders across fuselage form attachments for main wing spars. Rear portion is semi-monocoque structure with light alloy frames, longitudinal stringers and light alloy sheet covering. Maximum fuselage width 4 ft. 2 in. (1.27 m.).

Tail Unit.—All-metal cantilever structure. Tailplane has two light alloy spars, pressed sheet ribs and stressed metal skin, and is bolted to fuselage. Two-spar fin with main spar bolted to fuselage sternpost. Elevators have light-alloy D-spar, pressed sheet ribs and fabric covering. Rudder of similar construction with metal covering and with mass balance in horn-balanced portion. Controllable trim-tabs in rudder and elevators.

Landing Gear.—Fixed two-wheel divided type. Each unit consists of cantilever shock-absorber leg incorporating steel springs and recoil-damper, and is bolted to casting on front face of main spar. Streamlined Pytram fairing over leg and wheel. Medium-pressure wheels. Pneumatic brakes operated by rudder-bar. Track 12 ft. 0 in. (3.65 m.). Tail-wheel carried in full-swivelling self-centring fork which rotates in cast aluminium rocker-arm hinged at bottom of sternpost. Steel-spring shock-absorption with Ferodo band recoil-damper.

Power Plant.—One 296 b.h.p. D.H. Gipsy Queen 51 (Supercharged) or 251 b.h.p. D.H. Gipsy Queen 32 (Unsupercharged) six-cylinder in-line inverted air-cooled engine on rubber anti-vibration blocks on steel-tube mounting. De Havilland two-blade constant-speed airscrew. Cowling in four parts, side panels hinged on top centre-line. Two 20 Imp. gallon (91 litre) crash-proof fuel tanks in wing-roots between spars with detachable access panels in undersurface of wing. Oil tank of 4.9 Imp. gallons (22 litres) capacity in leading-edge of port wing root with oil-cooler inboard.

Accommodation.—Crew of three in ventilated and heated enclosed cockpit. Pilot (on starboard) and pupil side-by-side with dual control in front, with third central seat for second pupil undergoing air experience behind. Standard S.B.A.C. seats, front two adjustable. Entire cabin top made as complete unit and bolted to fuselage structure. Forward portion has direct-vision safety-glass windscreen. Perspex hood slides backward for access. Rear and top panels amber-tinted. Front windscreen and forward half of lower panel in sliding hood fitted with folding amber-coloured screens for night instruction. Rear seat entered through upward-sliding door on port. Steel-tube crash-pylon between front and rear seats. Cabin sides from main arch to front of rear door jettisonable.

Dimensions.—Span 46 ft. 0 in. (14.02 m.), Length 31 ft. 3 in. (9.52 m.), Height (tail up, over rudder) 12 ft. 10½ in. (3.9 m.).

Weights and Loadings (Gipsy Queen 51).—Weight empty 2,891 lbs. (1,311 kg.), Woight loaded 3,860 lbs. (1,750 kg.), Wing loading (at 3,860 lbs.=1,750 kg.) 12.65 lbs./sq. ft. (61.76 kg./sq. m.). Power loading (at 3,860 lbs.=1,750 kg.) 13 lbs./h.p. (5.89 kg./h.p.).

W.ights and Loadings (Gipsy Queen 32).—Weight empty 2,841 lbs. (1,288 kg.), Woight loaded 3,790 lbs. (1,719 kg.), Wing loading (at 3,790 lbs.=1,719 kg.) 12.42 lbs./sq. ft. (60.64 kg./sq. m.), Power loading (at 3,790 lbs.=1,719 kg.) 15.1 lbs./h.p. (6.85 kg./h.p.).

Performance (Gipsy Queen 51, at 3,860 lbs.=1,750 kg.).—Maximum speed 171 m.p.h. (275 km.h.) at 6,800 ft. (2,075 m.), Speed at sea level 153 m.p.h. (246 km.h.), Maximum continuous cruising speed 160 m.p.h. (257 km.h.) at 5,400 ft. (1,645 m.) at sea level 147 m.p.h. (236 km.h.), Maximum economic cruising speed 154 m.p.h. (248 km.h.) at 12,200 ft. (3,720 m.) at sea level 129 m.p.h. (207 km.h.), Stalling speed (with flaps) 62.4 m.p.h. (100 km.h.), with flaps 51 m.p.h. (82 km.h.), Initial climb at take-off power 1,070 ft./min. (326 m./min.), Climb at 5,000 ft. (1,525 m.) 960 ft. min. (292 m./min.), Climb to 5,000 ft. (1,525 m.) 5.25 minutes, Service ceiling (approximately) 19,000 ft. (5,790 m.), Take-off run (still air, at sea level, normal temperature, from grass) 200 yds. (183 m.), from concrete 175 yds. (160 m.), Take-off from grass to 50 ft. (15.24 m.) 370 yds. (338 m.), from concrete 345 yds. (315 m.), Ranges (at sea level, 129 m.p.h. (207 km.h.) 505 miles (813 km.) (duration 3.92 hours), at 5,000 ft. (1,525 m.) at 139 m.p.h.=324 km.h.) 517 miles (832 km.), Duration 3.72 hours.

Performance (Gipsy Queen 32 at 3,790 lbs.=1,719 kg.).—Maximum speed 155 m.p.h. (249 km.h.) at sea level at 5,000 ft. (1,525 m.) 151 m.p.h. (243 km.h.), Maximum continuous cruising speed 149 m.p.h. (240 km.h.) at 2,200 ft. (670 m.), at sea level 145 m.p.h. (233 km.h.), Maximum economic cruising speed 143 m.p.h. (230 km.h.) at 3,500 ft. (1,065 m.), at sea level 136 m.p.h. (219 km.h.), Stalling speed (without flaps) 61.8 m.p.h. (99 km.h.), with flaps 50.5 m.p.h. (81 km.h.), Initial climb 890 ft./min. (271 m./min.), at 5 000 ft. (1,525 m.) 670 ft./min. (204 m./min.), Climb to 5,000 ft. (1,525 m.) 6.5 minutes, Service ceiling (approximately) 18,000 ft. (5,485 m.) Take-off run (still air, at sea level, normal temperature) 200 yds. (183 m.), from concrete 175 yds. (160 m.), Take-off from grass to 50 ft. (15.24 m.) 390 yds. (356 m.), from concrete 365 yds. (335 m.), Ranges (at sea level, 136 m.p.h.=219 km.h.) 464 miles (747 km.) (duration 3.41 hours); at 5,000 ft. (1,525 m.) at 141 m.p.h. (227 km.h.) 495 miles (796 km.), (duration 3.51 hours.).

PERCIVAL—continued.

THE PERCIVAL MERGANSER.

Type.—Twin-engined High-wing monoplane for Feeder-line, Charter and Freight-carrying duties.

Wings.—Cantilever high-wing monoplane. Aerofoil section R.A.F. 48. All-metal two-spar structure in two main sections attached directly to fuselage. Detachable tips. Spars have extruded light-alloy flanges and reinforced plate webs. Each spar root has upper and lower lugs forming four-point wing attachments. False-spar with sealed ball-bearings hinges to carry control surfaces. Chordwise pressed light-alloy ribs and stiffeners, and stressed light-alloy skin, flush-riveted over critical drag area. Leading and trailing-edge sections built separately. Removable panels in undersurface for removing inter-spar fuel tanks. Gross wing area 319 sq. ft. (29.63 sq. m.). Each aileron has light alloy spar, pressed ribs and fabric covering. Controllable trim-tab in port aileron. Split trailing-edge flaps between ailerons and fuselage divided by nacelles, inter-connected by torque tube across fuselage and operated by pneumatic ram. Flap angles, 25 degrees for take-off, 50 degrees for landing.

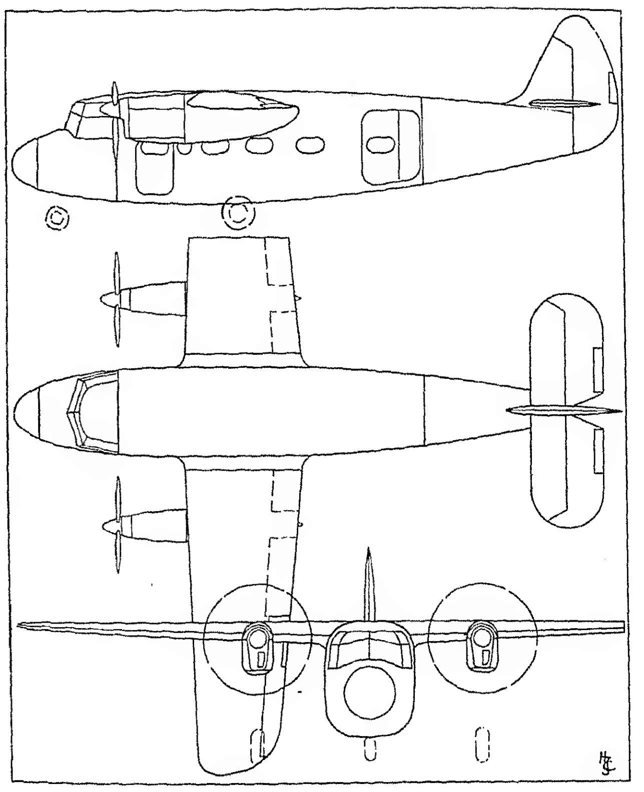
Fuselage.—All-metal monocoque structure in three main sections with transport joints at rear of pilot's cabin and at rear of passenger cabin. Structure of double-angle section light alloy frames and top-hat section stringers, with stressed light alloy covering flush-riveted over drag-sensitive areas. Nose detachable for access to controls and instruments.

Tail Unit.—All-metal cantilever monoplane type. Tailplane has two light alloy spars and pressed sheet ribs with sheet alloy covering flush-riveted over critical drag area. Attached to fuselage by two bolts at front spar and by one at rear spar. Each horn-balanced elevator has light alloy spar, pressed sheet ribs and fabric-covering, and is attached to tailplane spar by sealed ball bearing hinges. Controllable trim-tab in each elevator. Gross area (tailplane and elevators) 68.7 sq. ft. (6.38 sq. m.). Fin constructed as tailplane with main spar bolted to fuselage sternpost and forward end attached to front spar of tailplane. Rudder built as elevators, with horn-balanced portion at top housing mass-balance. Controllable trim-tab. Gross area (fin and rudder) 34.0 sq. ft. (3.16 sq. m.).

Landing Gear.—Retractable tricycle type. Main wheels with medium-pressure tyres, retract forward into engine nacelles and non-steerable nose-wheel retracts backwards into fuselage. Oleo-pneumatic shock-absorbers. Pneumatic retraction,with emergency gear. Track 15 ft. 0 in. (4.57 m.). Pneumatic brakes on main wheels. Twin floats or ski undercarriage optional.

Power Plant.—Two De Havilland Gipsy Queen 51 six-cylinder in-line inverted air-cooled supercharged engines, each developing 296 h.p. for take-off, mounted as power-eggs on shock-proof light alloy bearers at six points. De Havilland three-blade constant-speed full-feathering airscrews 7 ft. 6 in. (2.28 m.). diameter. Four crash-proof fuel-tanks with total capacity of 105 Imperial gallons (478 litres) in wings between spars, with provision for pressure filling. 5 Imperial gallon (23 litre) oil-tank and cooler mounted as component part of each engine.

Accommodation.—Provision for crew of two side-by-side with dual controls, though normally only one pilot carried. Vee-shaped windscreen of two flat safety-glass panels. Entry door in bulkhead aft of cockpit. Main passenger cabin 15 ft. 0 in. long × 5 ft. 6 in. wide × 6 ft. 0 in. high (4.57 × 1.68 × 1.8 m.) with entry door 5 ft. 0 in. × 2 ft. 3 in. (1.68 × .68 m.) at rear on port side. Door width can be increased to 4 ft. 0 in. (1.22 m.) for loading of freight by unlocking further portion. Standard cabin interior arrangement has seats for five or six passengers (three on port side and two or three on starboard side) with central gangway 17 in. (43 c/m.) wide. Overhead racks for personal luggage. Luggage compartment immediately aft of crew compartment with floor area of 22 sq. ft. (2 sq. m.) capacity of 110 cub. ft. (3.11 cub. m.) and with maximum allowance of 300 lbs. (136 kg.). Counter-balanced loading door 3 ft. wide × 4 ft. high (0.91 × 1.22 m.) on port side of fuselage. Toilet compartment at rear on starboard side opposite main entry door. With luggage compartment removed eight passenger seats can be installed or alternatively all interior equipment can be removed and entire cabin space used for freight-carrying. Built-in tie-down fittings, which do not project into passenger accommodation.



The Percival Merganser Light Transport.

Equipment.—Provision for up to 100 lbs. (45 kg.) radio equipment, T.K.S. liquid de-icing equipment, blind-flying equipment and Decca Navigator. 24-volt 750-watt electric system.

Dimensions.—Span 47 ft. 9 in. (14.55 m.), Length 39 ft. 8 in. (12.09 m.), Height (on ground, over rudder) 13 ft. 9 in. (4.19 m.).

Weights and Loadings (Designed).—Disposable load 2,110 lbs. (957 kg.), Weight loaded 6,700 lbs. (2,039 kg.), Wing loading 21 lbs./sq. ft. (102.48 kg./sq. m.), Power loading 11.35 lbs./h.p. (5.14 kg./h.p.).

Performance (Estimated).—Maximum speed 193 m.p.h. (331 km.h.) at 5,000 ft. (1,525 m.), Maximum speed at sea-level 180 m.p.h. (290 km.h.), Maximum continuous cruising speed 183 m.p.h. (294 km.h.) at 5,000 ft. (1,525 m.), Maximum economic cruising speed 167 m.p.h. (269 km.h.) at 8,000 ft. (2,440 m.), Stalling speed (with flaps) 69 m.p.h. (111 km.h.), Rate of climb at sea-level (maximum climbing power) 1,010 ft./min. (309 m./min.), at 5,000 ft. (1,525 m.) (maximum climbing power) 1,100 ft./min. (335 m./min.), Service ceiling 24,000 ft. (7,315 m.), One-engine ceiling 9,000 ft. (2,745 m.) Duration at 5,000 ft. (1,525 m.) 5 hours, Range, with 300 lbs. (136 kg.) luggage, five passengers and one crew 800 miles (1,287 km.), with 300 lbs. (136 kg.) luggage, six passengers and one crew 600 miles (966 km.), with 110 lbs. (50 kg.) luggage, six passengers and one crew 800 miles (1,287 km.), with 104 lbs. (47 kg.) luggage, eight passengers and one crew 400 miles (644 km.), with 9 lbs. (4 kg. luggage, eight passengers and one crew, 500 miles (805 km.), with 1,350 lbs. (612 kg.) freight 800 miles (1,287 km.), with 1,825 lbs. (839 kg.) freight, 300 miles (483 km.), Take-off distance in still air to 50 ft. (15 m.) 560 yds. (512 m.).

PORTSMOUTH.

PORTSMOUTH AVIATION LTD.

Head Office and Works: The Airport, Portsmouth, Hants.

Directors: E. L. Granville, M.P. (Chairman), L. M. J. Balfour, B.Sc., A.R.Ae.S., Flt. Lt. F. L. Luxmoore, D.F.C. (Director of Design), W. H. Jenks and A. G. Murray.

Portsmouth Aviation under the title of Wight Aviation Ltd. was registered in 1932. The Company operated air services between the Isle of Wight and the Mainland up to the outbreak of War, after which they devoted their resources to the repair of R.A.F. aircraft. They have gained a wide knowledge of constructional practices and operative defects and, as a result, have established an A.R.B. approved design organization and have entered the post-war aircraft manufacturing field with the Aerocar light commercial monoplane.

The Aerocar is a twin-engined twin-boom high-wing cabin monoplane with accommodation for pilot and four or five passengers which will be suitable for executive, air charter or private owner use. It may be fitted with either two 155 h.p. Cirrus Major III or 100 h.p. Cirrus Minor II engines. Other makes of engine of similar horsepower will be available to order.

Production of the Aerocar is being undertaken in part of the former Short Bros. factory on the Rochester Airport which has been allocated to Portsmouth Aviation, Ltd. by the Board of Trade.

THE PORTSMOUTH AEROCAR.

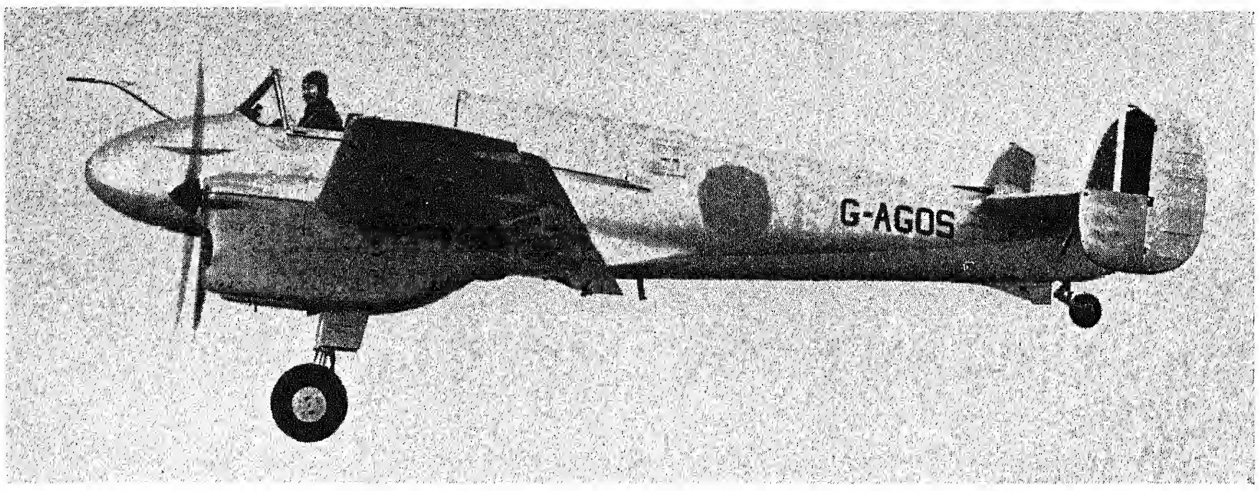
The Aerocar is an unconventional twin-engined twin-boom high-wing cantilever monoplane with an automobile type central body or fuselage depending from the centre-section between the booms. Accommodation is provided for pilot and four or five passengers. A monoplane tailplane interconnects the booms, each of which carries a terminal fin and rudder. The landing-gear is of the retractable tricycle type.

The power-plant will consist of either two 100 h.p. Blackburn Cirrus Minor II engines (four-passenger Aerocar) or two 155 h.p. Cirrus Major III engines (five-passenger Aerocar-Major). The specifications below refers to the Aerocar-Major.

Dimensions.—Span 42 ft. (12.8 m.), Length 26 ft. 3 in. (8 m.), Height (on ground) 10 ft. 7 in. (3.23 m.), Wing area (gross) 255 sq. ft. (23.7 sq. m.).

Weights.—Weight empty 2,600 lbs. (1,180 kg.), Disposable load 1,350 lbs. (613 kg.), Maximum take-off weight 3,950 lbs. (1,793 kg.), Maximum landing weight 3,800 lbs. (1,725 kg.).

Performance (Estimated).—Maximum speed 167 m.p.h. (267 km.h.), Maximum continuous cruising speed 153 m.p.h. (245 km.h.), Initial rate of climb 1,180 ft./min. (360 m./min.), Service ceiling 19,800 ft. (6,040 m.), Ceiling on one engine 7,500 ft. (2,290 m.), Cruising range 620 miles (1,000 km.) at 5,000 ft. (1,525 m.), Take-off run over 50 ft. (15.25 m.) 270 yds. (247 m.), Landing run into 5 m.p.h. (8 km.h.) wind 120 yds. (110 m.).



The Reid & Sigrist Desford Twin-engined Trainer (two 130 h.p. D.H. Gipsy Major Series I engines).—(*The Aeroplane.*)

REID & SIGRIST, LTD.

Head Office: Shannon Corner, Kingston By-Pass, New Malden, Surrey.

Aircraft Works: Desford, near Leicester.

Directors: Sqdn. Ldr. G. H. Reid, D.F.C., Wh.Ex., A.C.G.I., M.I.Ae.E. (Chairman and Managing Director) and E. A. M. Reid.

General Manager: H. P. Maskell.

Chief Designer: Charles Bower.

This well-known firm of instrument makers produced its first aircraft design in 1939. This was the twin-engined three-seat advanced training monoplane known as the Snargasher, a description and illustrations of which appeared in the 1939 edition of "All the World's Aircraft." Development of this type was suspended on the outbreak of war, when the Company became engaged on sub-contract work. This included the production of 700 Boulton Paul Defiant two-seat fighters, and the repair and modification of North American Mitchells for the R.A.F. The Reid & Sigrist organization also operated five Elementary Flying Training Schools in this country on behalf of the Air Ministry.

The Company has now produced the R.S.3 Desford twin-engined *ab initio* and intermediate training monoplane, the prototype of which flew on July 9, 1945. A description of the Desford follows.

The R.S.4 is a projected four/five-seat private owner's version of the Desford, which will be powered by Gipsy Major engines.

THE REID & SIGRIST R.S.3 DESFORD.

Type.—Twin-engined two-seat *Ab initio* and Intermediate Trainer.

Wings.—Cantilever low-wing monoplane. One-piece two-spar structure secured to fuselage by six bolts. Spars of laminated spruce with plywood webs, box-type ribs, spanwise spruce stiffeners and plywood covering. Gross wing area 186 sq. ft. (17.28 sq. m.), Dihedral 5 degrees, Incidence 3 degrees. Wooden ply-covered ailerons and flaps mounted below and behind trailing-edge and continuing under fuselage. Positions for climb, approach and touch down. Flaps pneumatically operated by Theed ram.

Fuselage.—All-wood oval-section structure consisting of four longerons and 21 vertical frames, longitudinal wooden stringers and plywood covering. Lower longerons broken where wing is attached to fuselage. Horizontal plywood diaphragm runs whole length of rear fuselage.

Tail Unit.—All-wood strut-braced tailplane with twin fins and rudders mounted as end-plates. Plywood covering to fixed surfaces and fabric covering to rudders and elevators. Trim-tabs in elevators.

Landing Gear.—Fixed two-wheel type. Each unit consists of semi-cantilever Lockheed airdraulic leg with offset axle and wheel, attached to front spar. Dunlop pneumatically-operated differential brakes. Fixed Dowty levered-suspension tail-wheel, with auxiliary faired skid.

Power Plant.—Two D.H. Gipsy Major Series I four-cylinder in-line inverted air-cooled engines; normal output (each) 120 h.p. at 2,100 r.p.m. at sea-level, maximum output (each) 130 h.p. at 2,350 r.p.m. at sea-level, driving two-blade fixed-pitch wooden airscrews; two D.H. Gipsy Major 10 four-cylinder in-line inverted air-cooled engines each rated at 139 h.p. at 2,400 r.p.m. for take-off and climbing, 145 h.p. at 2,550 r.p.m. for maximum level flight and 128 h.p. at 2,300 r.p.m. for maximum continuous cruising speed, driving two-blade manually-operated variable-pitch airscrews; or two D.H. Gipsy Major Series 30 four-cylinder in-line inverted air-cooled engines each rated at 160 h.p. at 2,500 r.p.m. for take-off and maximum level flight, 156 h.p. at 2,400 r.p.m. for maximum climb and 133 h.p. at 2,000 r.p.m. for maximum continuous cruising speed, driving two-blade constant-speed airscrews. Engines mounted on cantilever bearings of Jabroc impregnated wood supported by both wing spars. Two 22 Imp. gallon (100 litre) Henderson crash-proof fuel tanks between spars inboard of engines (one on each side of fuselage) mounted on hinged doors on underside of wings. Oil capacity 4.6 Imp. gallons (21 litres).

Accommodation.—Crew of two in separate tandem cockpits, pupil in front, with full blind-flying equipment, and instructor aft. Both cockpits enclosed by one-piece moulded sliding canopy which can be jettisoned.

Dimensions.—Span 34 ft. 0 in. (10.36 m.), Length 25 ft. 6 in. (7.77 m.), Height (on ground, tail down) 8 ft. 2 in. (2.48 m.).

Weights and Loadings (Gipsy Major Series I engines).—Weight empty (equipped) 2,477 lbs. (1,094 kg.), Crew with parachutes 400 lbs. (181 kg.), Fuel and oil 360 lbs. (163 kg.), Payload 63 lbs. (29 kg.), Maximum weight loaded 3,300 lbs. (1,497 kg.), Wing loading 17.74 lbs./sq. ft. (86.67 kg/sq. m.), Power loading 12.69 lbs./h.p. (5.76 kg./h.p.).

Weights and Loadings (Gipsy Major Series 10 engines).—Maximum weight loaded 3,460 lbs. (1,569 kg.), Wing loading 18.6 lbs./sq. ft. (90.82 kg./sq. m.), Power loading 12.4 lbs./h.p. (5.6 kg./h.p.).

Weights and Loadings (Gipsy Major Series 30 engines).—Maximum weight loaded 3,550 lbs. (1,610 kg.), Wing loading 19 lbs./sq. ft. (92.77 kg./sq. m.), Power loading 11 lbs./h.p. (4.98 kg./h.p.).

Performance (Gipsy Major Series I engines).—Maximum speed 162 m.p.h. (261 km.h.) at sea level, Maximum cruising speed 148 m.p.h. (238 km.h.) at sea level, Initial rate of climb 1,100 ft./min. (335 m/min.), Service ceiling 17,730 ft. (5,405 m.), Absolute ceiling 19,200 ft. (6,050 m.), Cruising range 463 miles (745 km.).

Performance (Gipsy Major Series 10 engines).—Maximum speed 176 m.p.h. (283 km.h.) at sea level, Maximum cruising speed 166 m.p.h. (267 km.h.) at sea level, Rate of climb 1,220 ft./min. (372 m./min.), Cruising range 507 miles (816 km.).

Performance (Gipsy Major Series 30 engines).—Maximum speed 181 m.p.h. (291 km.h.) at sea level, Maximum cruising speed 170 m.p.h. (274 km.h.), Rate of climb 1,416 ft./min. (432 m./min.), Cruising range 523 miles (842 km.).

SARO.

SAUNDERS-ROE LTD.

Head Office and Works: Cowes, Isle of Wight.

London Office: 45, Parliament Street, S.W.1.

Directors: Sir Alliott Verdon-Roe, O.B.E., F.R.Ae.S., M.I.Ae.E. (President), A. E. Chambers, A.M.I.C.E., F.Inst.Pet. (Chairman), A. Gouge, B.Sc., F.R.Ae.S. (Vice-Chairman), Capt. E. D. Clarke, M.C. (Managing Director), the Rt. Hon. Viscount Cowdray, the Hon. H. N. Morgan-Grenville, O.B.E., J. Lister Walsh and R. V. Perfect.

Director and Chief Designer: H. Knowler, F.R.Ae.S., A.M.I.C.E.

Secretary: P. D. Irons, B.Com., A.C.A., A.C.W.A.

Saunders-Roe Ltd. are designers and builders of all types of aircraft, ground and marine equipment, including trailers, trolleys, beaching chassis, arming and refuelling tenders, ammunition hoists, etc.

During the war Saunders-Roe, Ltd. was mainly engaged in the production of the Supermarine Walrus II and Sea Otter amphibian flying-boats, as well as sub-contract work for other manufacturers. Experimental work on modified forms of the S.37 small-scale flying-boat, previously illustrated and described in the 1940 edition of this annual, was also undertaken to obtain data for the future development of the large flying-boat.

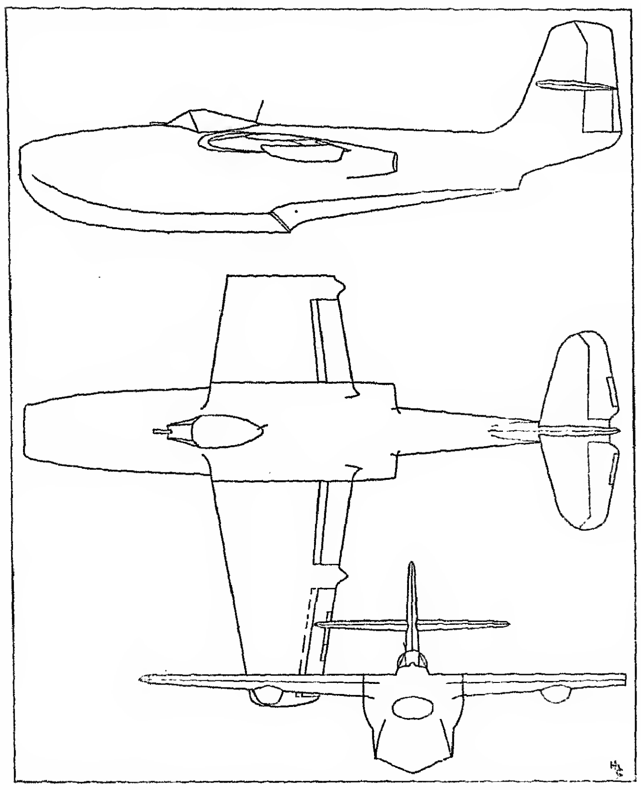
Saunders-Roe, Ltd. were responsible for the detail design and manufacture of the component parts of the wings, including flaps, ailerons, engine-mountings and wing-tip floats, of the Short Shetland four-engined flying-boat, a description of which will be found under "Short."

The company's present projects include a large six-engined commercial flying-boat for trans-ocean operations, three of which have been ordered by the Ministry of Supply, and a jet-propelled single-seat fighter flying-boat, the prototype of which was to be completed in 1946. Descriptions of both of these aircraft follow.

THE SAUNDERS-ROE S.R. A1.

The Saro S.R. A1 is an all-metal single-seat jet-propelled fighter flying-boat designed to Specification E.6/44. It was originally conceived for operation in the Pacific theatre before

SARO—*continued.*



The Saunders-Roe S.R. A1 Jet-propelled Flying-boat.

the end of the War, and construction of the prototype began in the Summer of 1945. It was expected to fly early in 1947.

TYPE.—Single-seat Fighter Flying-boat.

WINGS.—Cantilever high wing monoplane. High-speed aerofoil section. Structure consists of two main sections attaching to short stub centre-section integral with hull. All-metal single-spar structure with chordwise stiffeners and smooth metal skin. Equal taper on leading and trailing-edges. All-metal ailerons with trim and balance-tabs in each. Trailing-edge flaps between ailerons and hull. Aspect ratio 5 : 1. Taper ratio 2 : 1. Gross wing area 415 sq. ft. (38.54 sq. m.).

HULL.—Two-step metal structure with closely-spaced frames and smooth flush-riveted metal skin. Maximum beam 6.83 ft. (2.08 m.). Automatic pick-up device under planing bottom simplifies mooring and taxying. Semi-retractable stabilizing floats mid-way between hull and wing-tips.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with tailplane mounted half-way up fin. Balanced rudder and elevators with trim-tab in each.

POWER PLANT.—Two Metropolitan-Vickers F.2/4 axial-flow turbo-jet units mounted side-by-side in hull beneath wings. Oval-shaped air-intake in extreme bow and circular jet outlets aft of wing, one on each side of hull. Retractable cylindrical fairing projects forward from air-intake to prevent spray entering at take-off and alighting. Integral fuel tanks in wing leading-edge.

ACCOMMODATION.—Pressurized cockpit for pilot mounted above wing leading-edge. Sliding cover can be jettisoned in emergency.

ARMAMENT.—Four 20 m/m. cannon mounted in gun-bay in front of cockpit. Hinged cover allows re-arming and inspection.

DIMENSIONS.—Span 46 ft. 0 in. (14.02 m.), Length 50 ft. 0 in. (15.24 m.), Height 17 ft. 0 in. (5.18 m.).

WEIGHT LOADED.—Approximately 15,000 lbs. (6,804 kg.).

PERFORMANCE.—No data available.

THE SAUNDERS-ROE S.R. 45.

The Saro S.R.45 is a large projected passenger flying-boat which will be powered by six gas-turbines driving contra-rotating airscrews. The prototype is expected to fly some time in 1948.

The single-step hull will be of roughly figure-8 cross-section and divided into two decks. The whole of the passenger and crew cabins will be pressurised, and up to 100 passengers will be accommodated. The maximum cabin width will be 14ft. 6 in. (4.42 m.).

The wing will comprise a constant-chord centre-section carrying the engines, and two tapered outer wings with swept-back leading-edge and straight trailing-edge. Trailing-edge flaps in four sections each side will be fitted between the ailerons and the hull. Retractable stabilizing floats will be fitted under the wing-tips. The tail-unit will be a cantilever structure with a single fin and rudder and a dihedral tailplane.

DIMENSIONS.—Span 220 ft. 0 in. (67.05 m.), Length 146 ft. 0 in. (44.5 m.).

WEIGHT LOADED (Designed).—Over 250,000 lbs. (113,377 kg.).

PERFORMANCE (Estimated).—Cruising speed 300 m.p.h. (483 km.h.), Still-air range 5,000 miles (8,046 km.).

SHORT.

SHORT BROTHERS (ROCHESTER & BEDFORD), LTD.

HEAD OFFICE AND WORKS: ROCHESTER, KENT.

Honorary Life President: H. O. Short, F.R.Ae.S.

Directors: E. D. A. Herbert, O.B.E., M.A., A.M.I.C.E., M.I.Mech.E., M.I.E.E. (Chairman), D. E. Wiseman (Managing Director), E. B. Bowyer, Sir Sam Brown, Sir John S. Buchanan, C.B.E., F.R.Ae.S., and J. Lankester Parker, O.B.E., F.R.Ae.S.

Director and Chief Designer: C. P. T. Lipscomb, Wh.Ex., F.R.Ae.S.

Secretary: R. Prentice, C.A.

The firm of Short Brothers, which is the oldest established firm of aeroplane designers and producers in the United Kingdom, was founded by the brothers Eustace and Oswald Short in 1898, their work for some years being the manufacture of spherical balloons.

After the 1914-18 War, during which various types of naval aircraft were produced, Short Brothers concentrated on the development of the all-metal flying-boat, and their successes included the Calcutta and Kent (Scipio) civilian flying-boats and the various Singapore military designs.

In June, 1936, Short Brothers, in collaboration with Harland & Wolff, Ltd., the well-known Belfast ship-builders, formed a new company known as Short & Harland, Ltd. to build aircraft at Belfast. Further details of this Company may be found under "Short & Harland."

In July, 1938, a major shareholding was acquired by Short Brothers in Pobjoy Motors & Aircraft, Ltd., and production of the Short Scion twin-engined commercial monoplane was entrusted to that firm at Rochester Airport.

In July, 1936, the first Short Empire Boat *Canopus* was produced, and altogether the Company constructed thirty-one of this S-23, or C-class, type for Imperial Airways, Ltd. together with nine modified versions designated S-30. During the War some of these Boats were fitted with gun turrets and other military equipment and were operated on reconnaissance duties with R.A.F. Coastal Command. Three larger Boats of the S-26 or G-class type were also produced, and served in civilian and military capacities during the War. In 1939 two further modified boats, designated S-33, were delivered to British Overseas Airways Corporation.

The S-25 Sunderland, a direct development from the civilian Empire Boats, was constructed for the R.A.F., the total production amounting to 721. The Stirling was the first of the R.A.F.'s four-engined bombers and was widely used on both day and night operations. A total of 2,350 Stirlings was produced.

Current Short designs include the Sandringham, a civil development of the Sunderland; the Seaford military flying-boat; the Solent, its civilian counterpart; the Shetland civil flying-boat, and the Sturgeon twin-engined naval reconnaissance bomber and target-tug. The Sealand light twin-engined amphibian is under development.

The Company at present remains at Rochester, but at the time of writing plans were being made for the complete removal of the factory to Belfast.

THE SHORT STURGEON.

The Short S.A. 1 Sturgeon is a twin-engined naval reconnaissance bomber designed to Specification S.11/43, and was intended for operation from the *Ark Royal* and *Hermes* class aircraft-carriers. The design was submitted for naval approval in the summer of 1943, and in October of that year Short Brothers were given instructions to proceed. Two versions were projected, one to be powered by Bristol Centaurus radials and the other with Rolls-Royce Merlin engines, each driving contra-rotating airscrews. Subsequently only the Merlin version was completed and it flew in June, 1946.

Due to changing operational requirements the reconnaissance-bomber version was not put into production but a variation, the S.A.2 Sturgeon TT Mk. II, has been adopted as a target-tug aircraft.

The Mk. II will have a slightly lengthened nose, which will be made to fold for stowage, and will accommodate additional gear. The drogue targets will be stowed in the bottom of the fuselage and operated by a power-driven winch.

The following description applies to the Mk. I.

TYPE.—Twin-engined three-seat Naval Reconnaissance-Bomber.

WINGS.—Cantilever mid-wing monoplane. Aerofoil section NACA 642215.3 at root, NACA 642215.6 at tip. All-metal two-spar structure in three main sections consisting of constant-chord centre-section passing through fuselage and two tapered outer sections. Detachable tips. Spars have extruded heavy-gauge light-alloy booms and plate webs. Front spar in vertical plane, rear spar staggered forward 33 degrees to permit outer wings to fold. Pressed light-alloy ribs and stressed metal skin riveted on. Wing root joints of nickle-chrome castings. Outer wing sections fold rearwards hydraulically about rear spar to lie alongside fuselage, with leading-edges downwards. Hinge consists of pin-and-socket pivot incorporating swinging jury bracket. Forged fork-end fittings on front spar boom of centre-section connecting with lug fittings on inner ends of front spar in outer sections. Incidence 2 degrees; dihedral (outer wings) 3¾ degrees; root chord 12 ft. 7¼ in. (3.84 m.); standard mean chord 9 ft. 4¼ in. (2.85 m.); tip chord 4 ft. 9 in. (1.45 m.); aspect ratio 6.4; nett wing area 51.84

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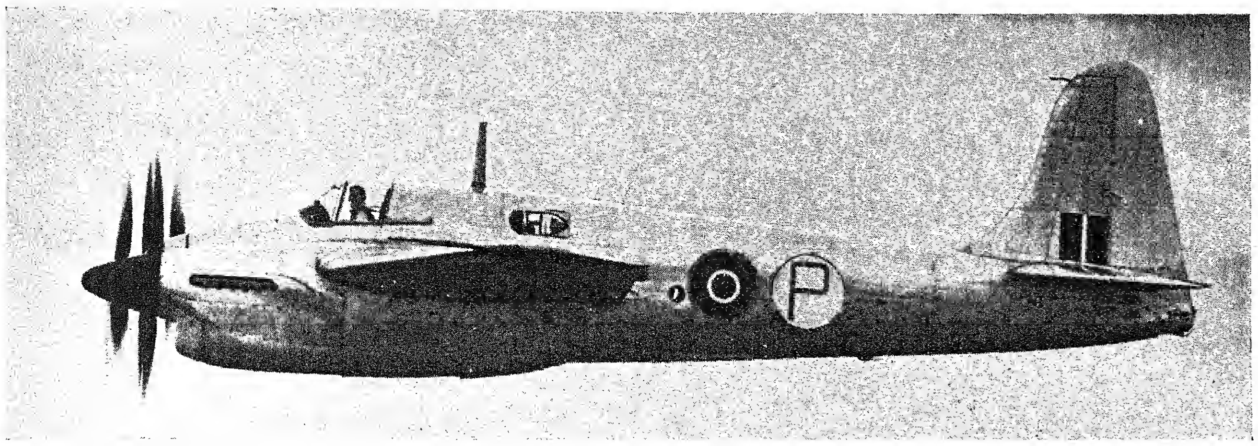


The Short Sturgeon I Three-seat Naval Reconnaissance-Bomber (two Rolls-Royce Merlin 140 engines).—(*The Aeroplane*).

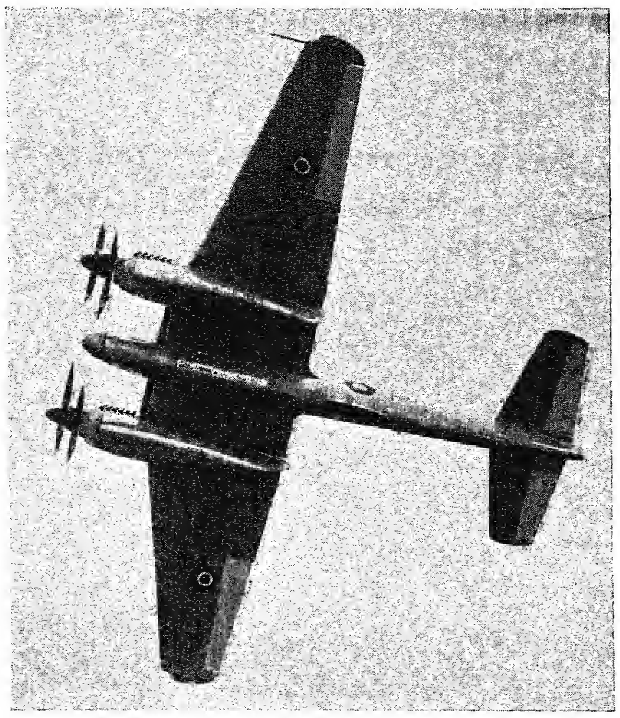
sq. ft. (48.16 sq. m.); gross wing area 560.4 sq. ft. (52 sq. m.). All-metal Frise-type ailerons with inset trim-tab and spring servo-tab in each. Aileron area (each—aft of hinge) 33.56 sq. ft (3.12 sq. m.); aileron movement 20 degrees each way; trim-tab area 0.228 sq. ft. (0.02 sq. in.); servo-tab area 1.56 sq. ft. (0.145 sq. m.). Zapp area-increasing split flaps on centre-section and outer wings between ailerons and fuselage. Hydraulic operation. Maximum depression 50 degrees; take-off angle 16 degrees. Flap area (total, each wing) 86.4 sq. ft. (8.03 sq. m.).

FUSELAGE.—All-metal monocoque structure in four main sections consisting of forward fuselage to rear of pilot's cockpit; centre fuselage to rear spar; rear fuselage to leading-edge of fin, and tail-end. Structure consists of channel-section light-alloy transversal frames; four channel-section light-alloy longerons; continuous L-section longitudinal stringers and stressed light-alloy skin riveted on. Maximun fuselage width 3 ft. 3 in. (0.99 m.); maximum depth 7 ft. 0 in. (2.13 m.).

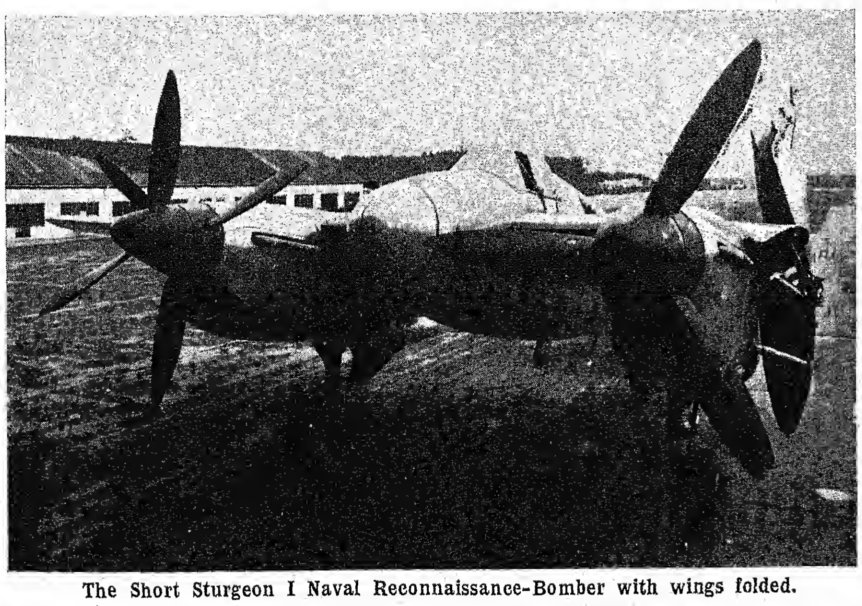
TAIL UNIT.—Cantilever monoplane type. Fin and tailplane integral with rear fuselage. Horizontal and vertical surfaces of R.A.F.30 aerofoil section. Tailplane is two-spar structure with plated light-alloy ribs, spanwise stringers and riveted metal skin. Fin similarly constructed. Elevators and horn-balanced rudder have metal frames and are fabric-covered. Elevators on set-back hinges. Combined servo/trim-tab in each elevator and in rudder. Tailplane span 20 ft. 0 in. (6.1 m.); root chord 7 ft. 0 in. (2.13 m.); standard mean chord 5 ft. 5 in. (1.68 m.); tip chord 3 ft. 8 in. (1.12 m.); gross tailplane and elevator area 108.22 sq. ft. (10 sq. m.); elevator area (each) 27.37 sq. ft. (2.54 sq. m.); elevator movement 24½ degrees up, 19 degrees down. Rudder height 11 ft. 7¼ in. (3.53 m.); gross fin and rudder area 72.7 sq. ft. (6.75 sq. m.); rudder area 16.6 sq. ft. (1.54 sq. m.); rudder movement 20 degrees each way; elevator tab area 1.69 sq. ft. (0.157 sq. m.); rudder tab area 1.28 sq. ft. (0.119 sq. m.).

LANDING GEAR.—Retractable two-wheel type. Each main wheel is carried on outside of Messier oleo-pneumatic shock-absorber leg with rear bracing strut and retracts backwards into engine nacelle being fully enclosed by twin doors. Electro-hydraulic operation with emergency pneumatic gear. Track 14 ft. 3 in. (4.34 m.). Main wheels fitted with pneumatic brakes. Tail-wheel carried in fork on levered-suspension shock-absorber leg retracts forward into fuselage and is enclosed by twin doors. Retractable R.A.E. A-frame deck arrester hook under rear fuselage.

POWER PLANT.—Two Rolls-Royce Merlin 140 twelve-cylinder vee liquid-cooled engines each rated at 1,660 h.p. for take-off; and with METO power of 2,050 h.p.; maximum level power of 2,080 h.p. at 2,000 ft. (610 m.); maximum cruising power of 1,220 h.p. and a maximum climbing power of 1,440 h.p. Engines mounted on steel-tube bearers attached to centre-section front spar and landing gear attachments, each driving two Rotol three-blade contra-rotating airscrews, with wood blades 10 ft. 0 in. (3.05 m.) diameter. Engine centres 13 ft. 10 in. (4.22 m.). Leading-edge intakes between engines and fuselage and under engines. Gallay glycol/oil radiator units. Marston flexible self-sealing fuel tanks with total capacity of 410 Imp. gallons (1,863 litres): two of 110 Imp. gallons (500 litres) capacity each and two of 95 Imp. gallons (432 litres) capacity each in centre-section. Auxiliary 180 Imp. gallon (819 litre) fuel tank can be installed in bomb-bay instead of bombs. One 22 Imp. gallon (100 litre) oil tank in each engine nacelle. Provision for R.A.T.O.G.



The Short Sturgeon I seen from underneath—(*The Aeroplane*).



The Short Sturgeon I Naval Reconnaissance-Bomber with wings folded.

ACCOMMODATION.—Crew of three. Pilot accommodated in enclosed cockpit in line with leading-edge of wing. Malcolm-type laminated bullet-proof windscreen and moulded bubble-type cover which slides backwards for access. Navigator in armoured station in fuselage ahead of wing trailing-edge, with bulged side windows and access door on port side. Radio-operator immediately aft.

ARMAMENT.—Two 0.5 in. (12.7 m/m.) machine-guns in nose, with provision for two more, and a total of 600 rounds. Eight rocket-projectiles can be carried, four under each wing. Bomb-bay in fuselage has hydraulically-operated doors and can accommodate one 1,000 lb. (454 kg.) or two 500 lb. (227 kg.) bombs; four depth-charges, or a long-range tank.

EQUIPMENT.—Radio/radar equipment comprises A.R.I. 5206 main transmitter/

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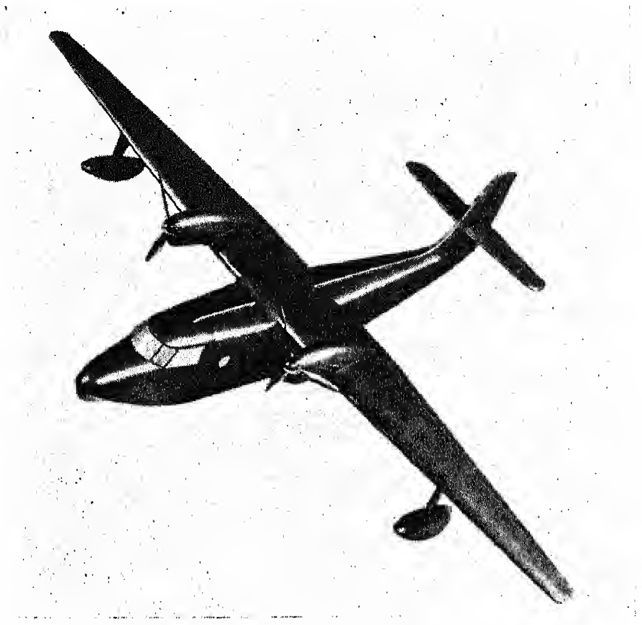


A model of the projected Short Sealand Amphibian.

receiver; A.R.I. 5272 auxiliary transmitter/receiver; A.R.I. 5284 radio altimeter; A.R.I. 5307 ZBX homing beacon; A.R.I. 5578 ASV with Type 77 Scanner; A.R.I. 5679 IFF Mk. III, and A.R.I. 5610 Rebecca IV. One F-24 and two F-52 vertical cameras in photographic-reconnaissance version in fuselage aft of wing trailing-edge. M-type dinghy in rear fuselage decking.

DIMENSIONS.—Span 59 ft. 11 in. (18.26 m.), Width folded 20 ft. 0 in. (6.1 m.), Length overall 45 ft. 4¼ in. (13.9 m.), Height 13 ft. 2½ in. (4.02 m.), Height folded 16 ft. 2½ in. (4.94 m.).

WEIGHTS AND LOADINGS.—Weight empty 15,475 lbs. (7,017 kg.); Fuel and oil (370 Imp. gallons=1,682 litres petrol, and 16 Imp. gallons=73 litres oil) 2,825 lbs. (1,282 kg.), Crew of three, parachutes and K-type dinghy each, 669 lbs. (304 kg.), Equipment 2,731 lbs. (1,239 kg.), Weight loaded 21,700 lbs. (8,842 kg.), Landing weight 17,500 lbs. (7,938 kg.), Wing loading 38.7 lbs./sq. ft. (189 kg./sq. m.), Power loading 6.5 lbs./h.p. (2.9 kg./h.p.).

PERFORMANCE (Estimated).—Maximum speed 430 m.p.h. (692 km.h.) at 19,000 ft. (5,790 m.), Speed at 24,200 ft. (7,925 m.) 395 m.p.h. (636 km.h.), Speed at 22,000 ft. (6,705 m.) 361 m.p.h. (581 km.h.), Landing speed 80 m.p.h. (129 km.h.), Maximum rate of climb (combat power) 4,120 ft./min. (1,250 m./min.) at sea level, Normal rate of climb at sea level 2,330 ft./min. (710 m./min.), Normal rate of climb at 15,000 ft. (4,570 m.) 2,080 ft./min. (634 m./min.), Service ceiling 35,700 ft. (10,880 m.), One-engine ceiling 23,600 ft. (7,195 m.), Normal range 1,035 miles (1,666 km.), Maximum range (with normal tankage) 1,600 miles (2,575 km.), Take-off run in still air 275 yds. (251 m.), Take-off run in 31 m.p.h. (50 km.h.) wind, 117 yds. (107 m.).

THE SHORT SEALAND.

The Sealand is a projected twin-engined light amphibian the prototype of which was under construction at the time of writing. It is to be a high-wing monoplane with a single fin and rudder, and fitted with a two-wheel landing gear which retracts into the sides of the hull. A noteworthy feature is the wide track of 10 ft. (3.05 m.). The power plant consists of two 330 h.p. D.H. Gipsy Queen 71 six-cylinder in-line inverted air-cooled engines mounted in the centre-section leading-edge, which drive constant-speed full-feathering and reversible-pitch airscrews, 8 ft. 3 in. (2.51 m.) diameter.

The cabin is arranged to accommodate five passengers, and there is capacity for 1,000 lb. (454 kg.) baggage. The whole of the cabin space can be quickly converted for freight carrying.

DIMENSIONS.—Span 59 ft. 0 in. (18 m.), Length 42 ft. (12.8 m.), Height (keel to top of rudder) 15 ft. 0 in. (4,57 m.), Gross wing area 354 sq. ft. (32.9 sq. m.).

WEIGHT AND LOADING (Designed).—Weight loaded 8,500 lbs. (3,855 kg.), Wing loading 24 lbs./sq. ft. (117 kg./sq. m.).

PERFORMANCE (Estimated).—Maximum speed 193 m.p.h. (310 km.h.) at 6,200 ft. (1,890 m.), Cruising speed 179 m.p.h. (288 km.h.) at 6,600 ft. (2,010 m.), Landing speed 64 m.p.h. (103 km.h.), Rate of climb at sea level 924 ft./min. (282 m./min.), Rate of climb at 10,000 ft. (3,050 m.) 786 ft./min. (240 m./min.), Service ceiling 21,500 ft. (6,555 m.), One-engine service ceiling 8,100 ft. (2,470 m.), Range (with 90 Imp. gallons=409 litres, five passengers and baggage) 454 miles (730 km) at 173 m.p.h. (278 km.) or 585 miles (941 km.) at 127 m.p.h. (204 km.h.), Maximum range (with 120 Imp. gallons=546 litres) 620 miles (998 km.) at 173 m.p.h. (278 km.h.) or 813 miles (1,308 km.) at 127 m.p.h. (204 km.h.), Take-off distance from water 600 yds. (549 m.) (28 seconds), Take-off from land 400 yds. (366 m.).

THE SHORT S.25/V SANDRINGHAM.

The Sandringham is a four-engined civil flying-boat, the basic airframe of which does not differ from that of the Sunderland described hereafter. The modifications are confined to secondary structural changes and to the complete re-arrangement of the interior. The bow and tail of the hull have been re-designed, completely eliminating the characteristics associated with the military version, and a mooring compartment has been provided in the bow with equipment closely following that of the Empire boat. The passenger accommodation is arranged on two decks, the general furnishings and finish fulfilling the requirements of the British Overseas Airways Corporation. The following variations of the Sandringham are available.

Sandringham I. 785 h.p. Bristol Pegasus 38 engines and D.H. three-blade constant-speed airscrews. Accommodation for twenty-four passengers by day and sixteen by night. Dining saloon and cocktail bar on upper deck.

Sandringham II. 1,200 h.p. Pratt & Whitney R-1830-90B Twin-Wasp engines and Hamilton Standard Hydromatic three-blade airscrews. Accommodation for forty-five day passengers, 28 on lower deck and 17 on upper deck. Cocktail bar on upper deck.

Sandringham III. As Mk. II, except fitted for 21 day passengers. Dining saloon and galley on upper deck.

Sandringham IV. As Mk. II except fitted for thirty day passengers. Pantry on upper deck.

Sandringham V. As Mk. II except fitted for twenty-two day or sixteen night passengers. Pantry on lower deck.

Sandringham VI. As Mk. II except fitted for thirty-seven day passengers. Pantry on lower deck.

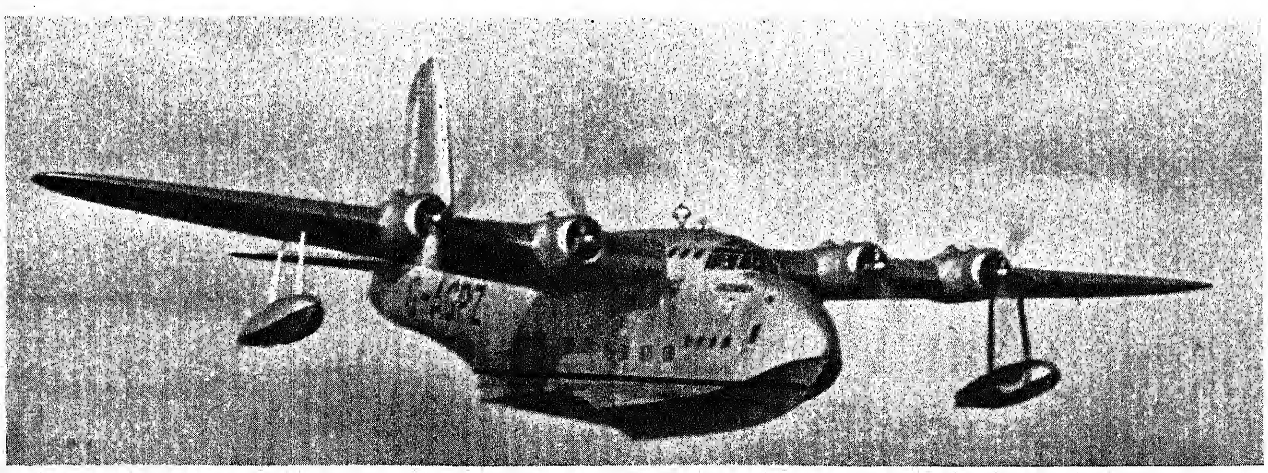
Sandringham VII. As Mk. II but with accommodation for 30 passengers for use on Baltimore-Bermuda service of B.O.A.C. All-up weight 60,000 lbs. (27,240 kg.).

TYPE.—Four-engined Commercial Flying-boat.

WINGS, HULL AND TAIL UNIT.—Structure as Sunderland.

POWER PLANT—Four 785 h.p. Bristol Pegasus 38 nine-cylinder radial air-cooled engines driving de Havilland Hydromatic three-blade constant-speed full-feathering airscrews, or four 1,200 h.p. Pratt & Whitney R-1830-90B fourteen-cylinder two-row radial air-cooled engines driving Hamilton Standard Hydromatic three-blade constant-speed airscrews, 12 ft. 1 in. (3.68 m.) diameter. Fuel tanks in wings as on Sunderland. Maximum fuel capacity 2,032 Imp. gallons (9,243 litres). Maximum oil capacity 112 Imp. gallons (409 litres).

ACCOMMODATION.—Normal crew of seven, comprising two pilots, navigator, radio-operator, flight-engineer, purser and steward. Flight deck similar to that of Sunderland civil conversion. Two pilots, side-by-side with dual controls; navigator and radio-operator behind pilots, the former facing forward and the latter (on starboard side) to starboard. An Alco auxiliary power-unit is located on the flight deck between radio-operator and the front spar frame. Flight engineer's position to starboard between spar frames and facing aft. Crew's rest station on port side with two bunks, table for meals, etc. Access to flight deck through hatch



The Short Sandringham II Commercial Flying-Boat (four 1,200 h.p. Pratt & Whitney Twin-Wasp engines).

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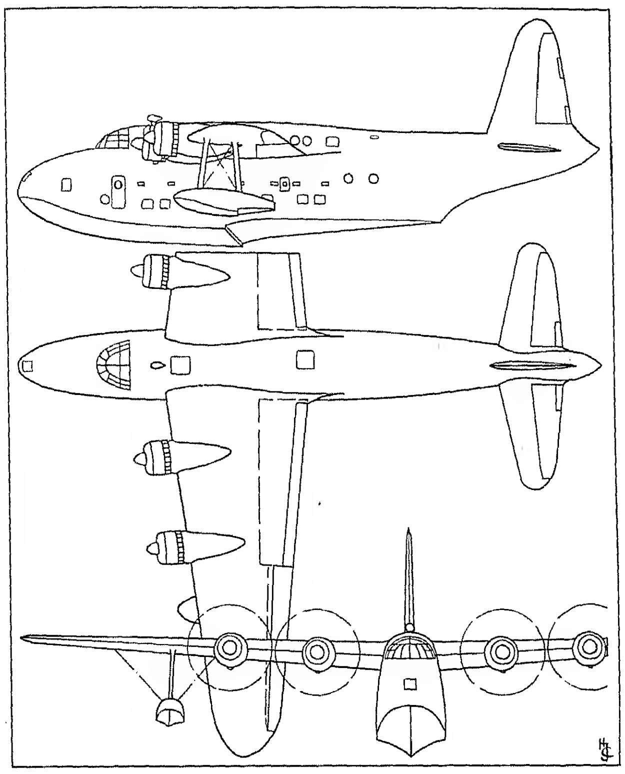


The Short Sandringham Flying-boat.

between pilots' seats and a hanging ladder providing communication to forward lavatory and purser's office on lower deck. Alternative arrangements provide for twenty-one, thirty, thirty-seven or forty-five day passengers or twenty-two by day and sixteen by night, the passenger arrangements affecting the disposition of the galley, pantry, etc. The Mk. II has four cabins on the lower deck seating eight, five, eight and seven passengers respectively. Two toilet compartments are installed forward, opposite the main entry door on the port side. The rear freight compartment has a capacity of 516 cub. ft. (14.59 cub. m.) and a hinged loading hatch on the starboard side. The forward freight compartment has a capacity of 150 cub. ft. (4.24 cub. m.). Total freight capacity 666 cub. ft. (18.83 cub. m.); maximum freight allowance 4,250 lbs. (1,928 kg.). The two rear cabins are convertible for freight-carrying, increasing the freight capacity to 7,610 lbs. (3,452 kg.) and decreasing the passenger accommodation to twenty-six. On the upper deck, immediately aft of the crew quarters, is a cocktail bar, with seats for five passengers, and beyond the stairway is the rear cabin seating twelve passengers. On sleeper version seats are convertible to bunks; dressing-rooms are provided and there is a buffet equipped with refrigerator, steam oven, sink, etc. and a service lift to snack bar. Particulars of the alternative accommodation arrangements are given at the head of this specification. The cabin windows are of the emergency push-out type, and four collapsible dinghies are carried in the wings.

DIMENSIONS.—As Sunderland, except length 86 ft. 3 in. (26.28 m.).

WEIGHTS AND LOADINGS (Mk. I day version).—Weight empty 34,150 lbs. (15,490 kg.), Removable equipment 2,400 lbs. (1,089 kg.), Fuel and oil 10,590 lbs. (4,803 kg.), Crew 1,260 lbs. (571 kg.), Payload 7,600 lbs. (3,447 kg.), Maximum take-off weight 56,000 lbs. (25,400 kg.), Wing loading (fully loaded) 33.1 lbs./sq. ft. (161.5 kg./sq. m.), Power loading 14.6 lbs./h.p. (6.6 kg./h.p.).

WEIGHTS AND LOADINGS (Mk. I night version).—Weight empty 34,150 lbs. (15,490 kg.), Removable equipment 2,400 lbs. (1,089 kg.), Fuel and oil 9,993 lbs. (4,532 kg.), Crew 1,260 lbs. (571 kg.), Payload 8,197 lbs. (3,718 kg.). Loadings as day version.

WEIGHTS AND LOADINGS (Mk. II).—Weight empty (equipped) 41,370 lbs. (18,765 kg.), Crew 1,260 lbs. (571 kg.), Fuel and oil 10,590 lbs. (4,804 kg.), Payload 6,780 lbs. (3,075 kg.), Payload with 1,610 Imp. gallons (7,322 litres) 9,915 lbs. (4,497 kg.), Wing loading 35.5 lbs./sq. ft. (173.3 kg./sq. m.), Power loading 12.5 lbs./h.p. (5.65 kg./h.p.).

PERFORMANCE (Mk. I day version).—Maximum speed 215 m.p.h. (346 km.h.) at 900 ft. (274 m.), Maximum economic cruising speed 184 m.p.h. (296 km.h.) at 9,000 ft. (2,745 m.), Rate of climb at sea-level 557 ft./min. (170 m./min.), Service ceiling 14,150 ft. (4,315 m.), Still-air range 1,600 miles (2,575 km.) at 5,000 ft. (1,525 m.), Take-off time 58 seconds.

PERFORMANCE (Mk. I night version).—As day version, except still-air range 1,497 miles (2,410 km.) at 5,000 ft. (1,525 m.).

PERFORMANCE (Mk. II, at 56,000 lbs.=25,400 kg.).—Maximum speed (approximate) 238 m.p.h. (383 km.h.) at 5,000 ft. (1,525 m.), Maximum rich-mixture cruising speed (approximate) 221 m.p.h. (356 km.h.) at 9,000 ft. (2,745 m.), Rate of climb at sea level 1,000 ft./min. (305 m./min.), Service ceiling 21,300 ft. (6,490 m.), three-engine ceiling 14,800 ft. (4,510 m.), Still-air range (with 9,915=4,497 kg. payload, at 176 m.p.h.=283 km.h.) 1,410 miles (2,269 km.), Still-air range (with 2,780 lbs.=1,261 kg. payload, at 179 m.p.h.=288 km.h., full tanks) 2,487 miles (4,002 km.), Take-off time 53 seconds.

THE SHORT S.35 SHETLAND.

The Shetland was projected as a long-range reconnaissance flying-boat, and was designed to conform to the requirements of Specification R.14/40. Design work was begun in 1940, but before completion its conception as a reconnaissance aircraft was abandoned owing to a change in official policy. It was subsequently intended as a military transport flying-boat, but its purpose was again modified and it was later recast as a purely commercial project. The prototype made its first flight on December 14, 1944, from the Medway. Certain military features had already been incorporated, but they were faired over with smooth metal sheet. The first prototype was accidently destroyed by fire on January 28, 1946, while moored at Felixstowe.

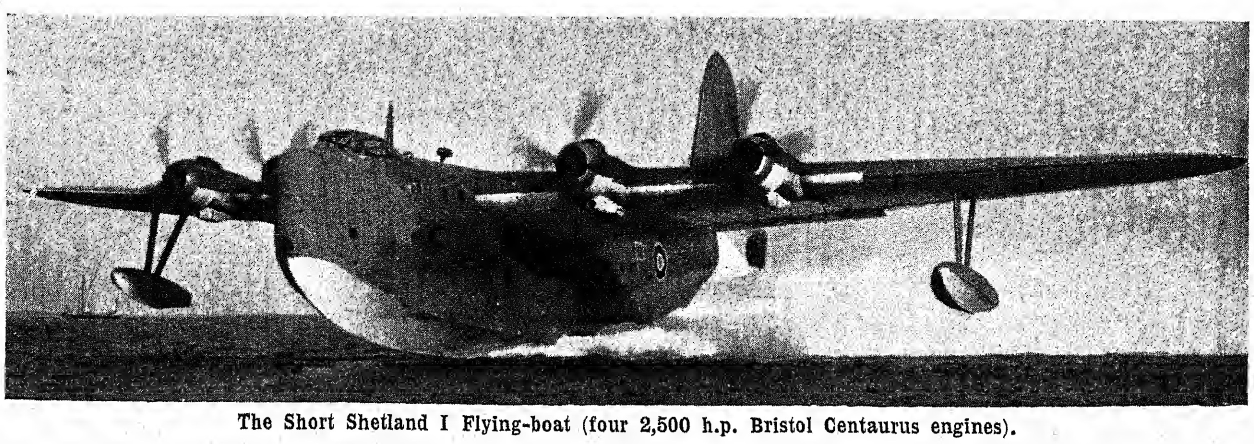
A second prototype, the Shetland II, was under construction at Rochester at the time of writing. It is being completed as a civil design for British Overseas Airways Corporation and will have a smooth nose and tail reminiscent of the Empire Boats.

The first Shetland was designed and constructed by Short Bros., with the collaboration of Saunders-Roe, Ltd. The original design was conceived by Short Bros., who were responsible for the manufacture, assembly and flight testing of the aircraft. Saunders-Roe, Ltd. were responsible for the detail design and manufacture of the component parts of the wings, including the flaps, ailerons, engine mountings and wing-tip floats.

Although a maximum of 70 passengers could be accommodated, the furnishing and equipment of the first Shetland provided for a maximum of 40 day passengers with sleeping facilities for 24. The following specification applies to the Mk. I so arranged.

WINGS.—High-wing cantilever monoplane of all-metal construction. Aerofoil section modified Göttingen 436. Aspect ratio: 8.62. Swept-back leading-edge, straight trailing-edge. Three spar structure, the two front spars forming sides of a torsion box. Spars have reinforced sheet webs and either L or T-section extruded booms. Between two front spars is a series of diaphragm bulkheads, a heavy skin supported by lateral stringers completing the box. Remainder of wing is built up of relatively light diaphragm ribs with the skin riveted to Z-section lateral stringers which are, in turn, bolted to the cap extrusions of the ribs. Fabric-covered Frise-type ailerons. Handley Page slotted flaps of all-metal construction. Wing area 2,636 sq. ft. (245 sq. m.).

HULL.—All-metal two-step structure of typical Short design and construction. A series of channel-section frames, doubled back-to-back in the midship section, and longitudinal stringers carrying the skin plating. Above the window base line the stringers are of open top-hat section and the frames are notched for their passage. Below this line the stringers are of Z-section and are notched for frame passage. Below lower deck level the hull is divided into compartments by shallow stiffened bulkheads which are edged with extrusions to which the floor bearers and hull bottom stringers are attached. Heavy bracing structures enclosed with double solid and reinforced bulkheads are located at the wing spar stations. Upper deck carried on transverse channel section beams at each frame station, with two built-up box-section beams and a series



The Short Shetland I Flying-boat (four 2,500 h.p. Bristol Centaurus engines).

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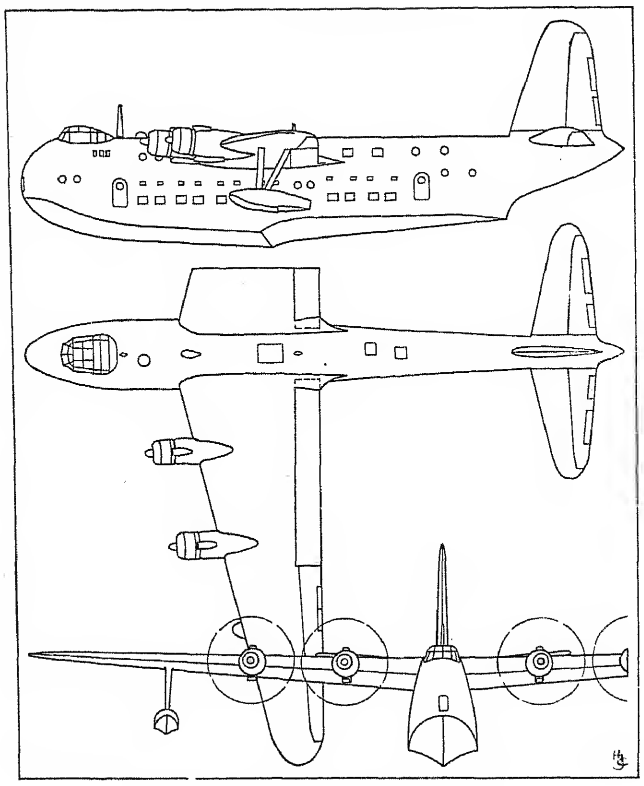


The Short Shetland II Flying-boat.

of Z-section stringers running fore-and-aft from mooring compartment bulkhead to the front bulkhead of the after entrance vestibule. Maximum beam 12 ft. 6 in. (3.8 m.).

TAIL UNIT.—Cantilever monoplane type. All-metal fixed surfaces, fabric-covered control surfaces. Rudder control has electric boost mechanism to provide three-fourths of the force required to move the rudder.

POWER PLANT.—Four 2,500 h.p. Bristol Centaurus eighteen-cylinder two-row radial air-cooled sleeve-valve engines, each fitted with a Rotol cooling fan and driving a D.H. Hydromatic four-blade constant-speed full-feathering airscrew. The two inboard airscrews are also reversible. Ten fuel tanks in wings. Total fuel capacity 6,112 Imp. gallons (27,803 litres). Oil tanks housed in the wing torsion box immediately aft of each nacelle. Total oil capacity 280 Imp. gallons (1,273 litres).

ACCOMMODATION.—Arranged on two decks. Flight compartment on upper deck forward of leading-edge of wings, accommodates two pilots forward, navigator and radio operator at stations against the starboard wall and the flight engineer facing aft at rear end of compartment. Engineer is provided with all instruments and controls for all mechanical and electrical systems throughout the aircraft except the actual flight controls and services. On the port side of the flight compartment a stairway leads to lower deck. Aft of stairhead is a settee, convertible to two bunks, for off-duty crew. Continuing aft along upper deck are the auxiliary engine-room (between wing spars) housing two Rotol generating plants for the supply of all ancilliary services; the main mail compartment (247 cub. ft. = 6.98 cub. m. capacity) with loading hatch 4 ft. 8 in. × 4 ft. (1.42 m. × 1.22 m.) in roof; a fully-equipped kitchen; dining saloon or lounge seating 12; cocktail bar, from which a staircase leads down to rear entry vestibule on lower deck. Vestibule has entrance door on port side and toilet on starboard side. Purser's office beneath stairway. Opposite stairway is a commodious coat-room and aft of vestibule is the men's dressing-room. In the extreme tail there is stowage space for passengers' hand baggage. Above the dressing room is a second mail or freight compartment (185 cub. ft. = 5.23 cub. m. capacity). Going forward from vestibule along lower deck are four passenger cabins, each seating two and convertible into two-berth sleeping cabins; four toilets; eight passengers cabins, each seating four and convertible into two-berth sleeping cabins: and forward entrance vestibule, on starboard side of which is a ladies' toilet and separate ladies' dressing room. In the nose of the hull are the mooring compartment, crew's toilet and crew entrance door with stairway to flight deck.

EQUIPMENT.—All accommodation insulated for noise and temperature. Two Rotol auxiliary generating units, each capable of supplying 20 kw. at 110 volts A.C., provide current for all services, including bilging and refuelling. Power also available from this plant for lighting, cooking, refrigeration and air-conditioning both in flight and at moorings.

DIMENSIONS.—Span 150 ft. (45.75 m.), Length 108 ft. (32.94 m.), Height (on trolleys) 38 ft. 8 in. (11.8 m).

WEIGHTS AND LOADINGS.—Weight empty (including all services and equipment, food and water, etc. and crew of eleven): 75,855 lbs. (34,438 kg.), Fuel and oil (6,112 Imp. gals. = 27,803 litres petrol and 280 Imp. gals. = 1,273 litres oil) 46,525 lbs. (21,122 kg.), Payload (for maximum range) 7,620 lbs. (3,464 kg.), Weight loaded 130,000 lbs. (59,020 kg.), Wing loading 49.3 lbs./sq. ft. (240 kg./sq. m.).

PERFORMANCE.—Maximum speed 267 m.p.h. (427 km.h.) at 8,000 ft. (2,440 m.), Initial rate of climb at full load 660 ft./min. (200 m/min.).

RANGES.—With 7,620 lbs. (3,464 kg.) pay-load 4,650 miles (7,440 km.) at 184 m.p.h. (294 km.h.), With 22,000 lbs. (9,979 kg.) pay-load 3,000 miles (4,800 km.) at 185 m.p.h. (295 km.h.), With 30,025 lbs. (13,630 kg.) pay-load 2,076 miles (3,322 km.) at 188 m.p.h. (301 km.h.).

THE SHORT S.45 SEAFORD.

The Seaford has been developed from the Sunderland III, the original designation for the S.45 being Sunderland IV. Designed to Specification R.8/42 to operate at an all-up weight of 75,000 lbs. (34,020 kg.), the hull has been given a bigger planing bottom with a 1 ft. (.305 m.) increase in beam, a 3 ft. 3 in. (0.99 m.) increase in length forward of the main step and a corresponding increase in length aft. The wings, of the Sunderland type, have been strengthened and the tail-unit modified with a dihedral tail plane and a dorsal fin added to the standard Sunderland fin.

The original Sunderland IV power-plant consisted of four Bristol Hercules XVII engines but in the Seaford these have been replaced by Hercules 100 units. D.H. Hydromatic four-blade full-feathering airscrews are fitted.

The armament consists of two .5 in. (12.7 m/m.) machine-guns in a Brockhouse power turret and four fixed .303 in. (7.9 m/m.) guns in the nose of the hull; two 20 m/m. cannon in a B·17 type mid-upper turret two .50 in. (12.7 m/m.) beam guns; and two .5 in. (12.7 m/m.) guns in a Glenn Martin tail turret. Bomb and depth-charge loads and stowage are the same as for the Sunderland V.

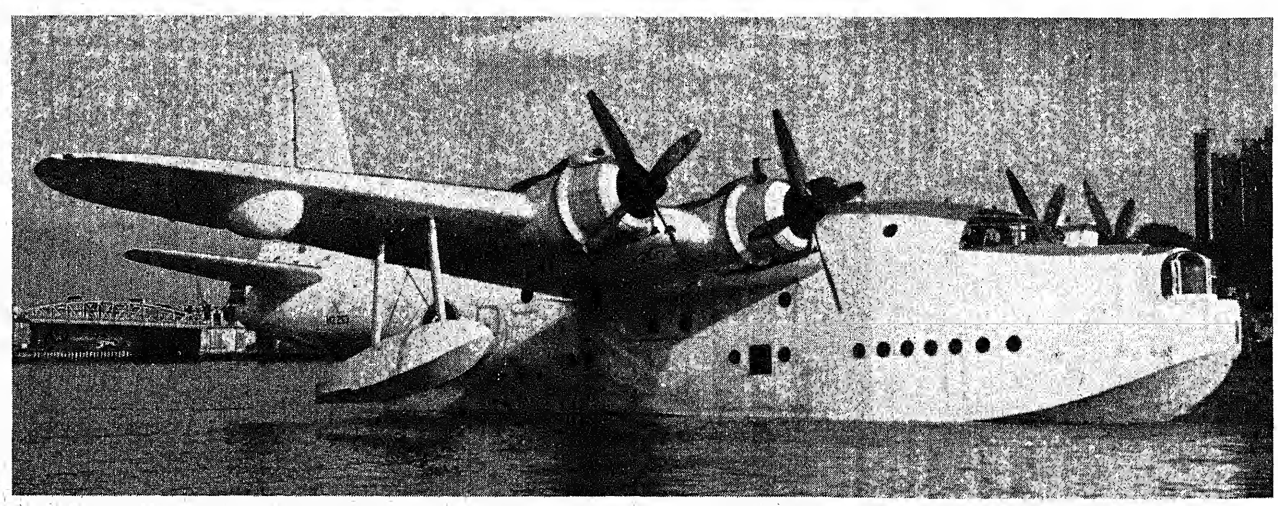
DIMENSIONS.—Span 112 ft. 9½ in. (34.39 m.), Length 88 ft. 6¾ in. (27.1 m.), Height (to top of fin) 34 ft. 3¼ in. (10.45 m.).

WEIGHTS AND LOADINGS.—Weight empty 45,000 lbs. (20,450 kg.), Typical service load (including crew) 8,200 lbs. (3,730 kg.), Petrol and oil 21,800 lbs. (9,880 kg.), Normal loaded weight 75,000 lbs. (34,020 kg.), Wing loading 44.5 lbs./sq. ft. (217 kg./sq. m.), Power loading 10.9 lbs./h.p. (4.95 kg./h.p.).

PERFORMANCE.—Maximum speed 242 m.p.h. (389 km.h.) at 500 ft. (152 m.), Maximum economical cruising speed 207 m.p.h. (333 km.h.) at 7,000 ft. (2,135 m.), Initial rate of climb 875 ft./min. (267 m./min.), Service ceiling 13,000 ft. (3,960 m.), Normal range in still air 2,800 miles (4,500 km.), Overload range in still air 3,100 miles (4,980 km.).

THE SHORT S.45 SOLENT.

The Solent is the civil version of the Seaford, and is intended as a high-performance flying-boat specially suitable



The Short Seaford General Reconnaissance Flying-boat (four Bristol Hercules 100 engines).

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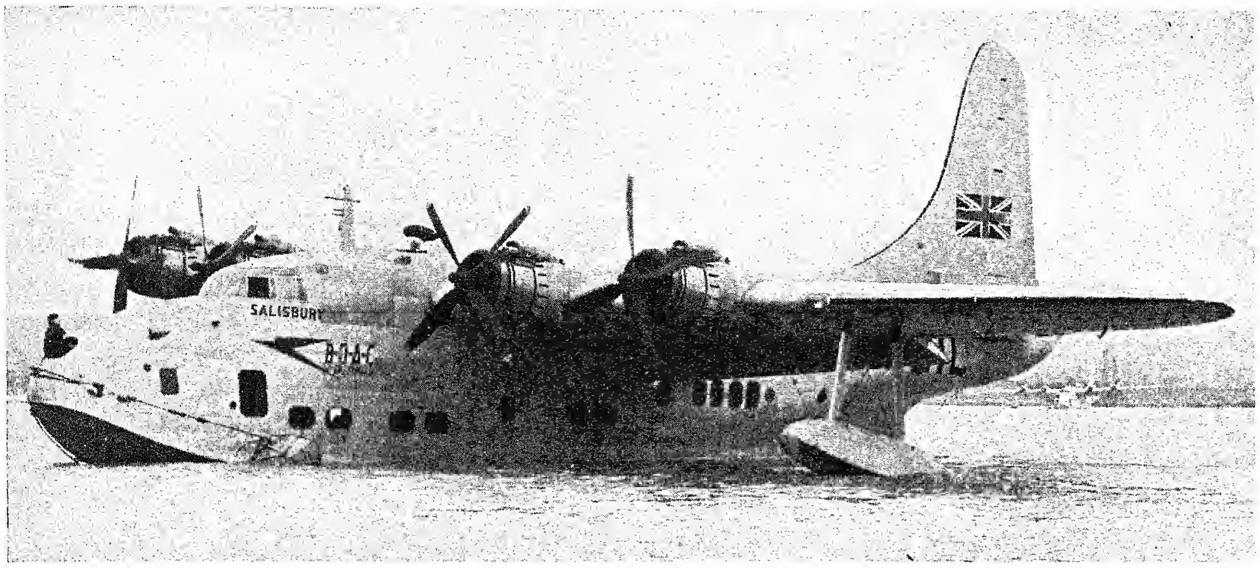


The Short Solent Commercial Flyng-boat (four Bristol Hercules 637 engines).—(*The Aeroplane*).

for operation on long-range overseas air routes. Nine have been acquired by British Overseas Airways Corporation, and three by Tasman Empire Airways. It has been designed to accommodate thirty passengers and to have a maximum range of 3,000 miles (4,828 km.) with eleven passengers.

In general form the Solent resembles the Sunderland and Seaford, having the longer hull and dorsal fin of the latter, and is constructed of light alloy. The hull has a two-step planing bottom divided into watertight compartments by vertical bulkheads. Transverse frames and longitudinal intercostal stiffeners form the main structure, with double frames at the main wing and tailplane attachment points.

The power plant consists of four Bristol Hercules 637 fourteen-cylinder two-row sleeve-valve radial air-cooled engines driving D.H. four-blade constant-speed full-feathering metal airscrews. Fuel tanks with a total capacity of 1,400 Imp. gallons (6,377 litres) are installed in the wings.

The hull is divided into two decks. On the upper deck are the crew compartment, galley, cocktail bar and two passenger cabins, while three passenger cabins, dressing rooms, lavatories and a promenade cabin are on the lower deck. Each of the passenger cabins can be quickly converted for sleeping accommodation.

Dimensions.—As Seaford.

Weights and Loading (Designed).—Weight empty 43,280 lbs. (19,632 kg.), Fuel and oil 19,621 lbs. (8,900 kg.), Crew 1,190 lbs. (540 kg.), Removable equipment 7,909 lbs. (3,587 kg.), Payload 7,909 lbs. (3,587 kg.), Weight loaded 75,000 lbs. (34,020 kg.), Maximum alighting weight 55,487 lbs. (25,146 kg.), Wing loading (fully loaded) 44.4 lbs./sq. ft. (217 kg./sq. m.).

Performance (Estimated).—Maximum speed 273 m.p.h. (439 km.h.) at 7,500 ft. (2,285 m.). Speed at 4,600 ft. (1,400 m.) 241 m.p.h. (388 km.h.), Speed at 8,500 ft. (2,590 m.) 232 m.p.h. (373 km.h.), Rate of climb at sea level 1,050 ft./min. (320 m./min.), Three-engine rate of climb at sea level 545 ft./min. (166 m./min.), Service ceiling 17,800 ft. (5,425 m.), Three-engine service ceiling 12,200 ft. (3,720 m.), Range (at 75,000 lbs.=34,020 kg. with 30 passengers and baggage) 2,330 miles (3,750 km.) at 213 m.p.h. (343 km.h.), Maximum range (at 75,000 lbs.=34,020 kg. with 11 passengers and baggage) 3,000 miles (4,828 km.), Take-off run (at 75,000 lbs.=34,020 kg.) 1,120 yds. (1,024 m.) (43 seconds), Take-off (at 60,000 lbs.=27,216 kg.) 476 yds. (435 m.) (22 seconds).

THE SHORT S.25 SUNDERLAND.

The Sunderland was designed to meet the requirements of Air Ministry Specification R.2/33 and is virtually a military version of the Empire Boat. The prototype first flew in 1937, a year after the first Empire Boat began its trials, and by the outbreak of War there were several squadrons in service and other units were in process of re-equipment or formation. The Sunderland was notable for being the first flying-boat to be equipped with power-operated gun-turrets.

The Sunderland was produced in the Mark I, II, III and V versions. A total of 721 was built and the last, a Mk. V, was completed by Blackburn Aircraft, Ltd., at Dumbarton on October 19, 1945. Many Sunderlands are still in use in this country and overseas. Details of the earlier versions were given in the 1945-46 edition of "All the World's Aircraft"; the following specification applies to the Mk. V.

Type.—Four-engined Reconnaissance Flying-boat.

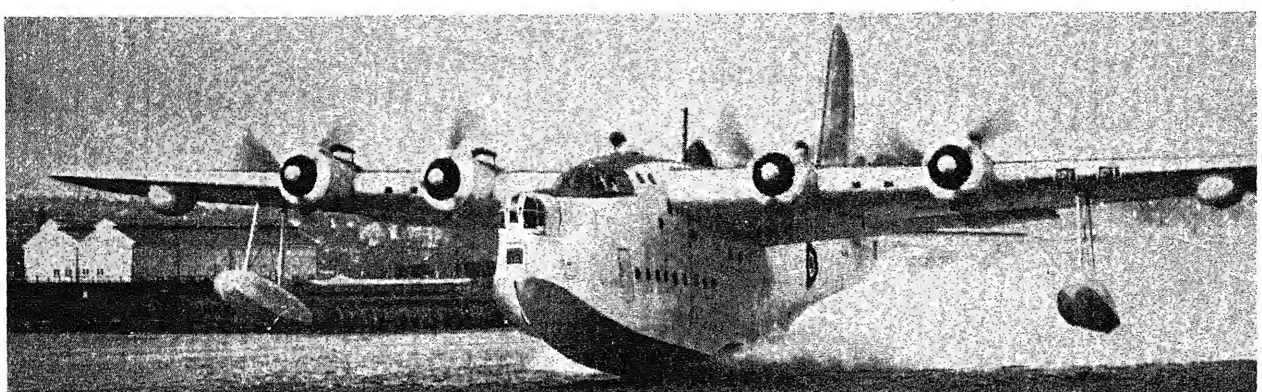
Wings.—Cantilever high-wing monoplane. Structure consists of four extruded T-sections which form the corners of a box spar. These are braced in the lift bays by tubular struts, and in the drag bays by built-up members. Separate leading and trailing-edge sections. With exception of trailing-edge portion of the ailerons, the whole wing, including the Gouge flaps is metal-covered. Aileron area 134 sq. ft. (12.44 sq. m.); flap area 286 sq. ft. (26.56 sq. m.); nett wing area 1,487 sq. ft. (138 sq. m.); gross wing area 1,687 sq. ft. (156.6 sq. m.).

Hull.—Channel-section frames, interconnected by Z-section stiffeners. Sheeting is riveted on longitudinally with countersunk rivets. Maximum beam 9 ft. 9 in. (2.97 m.); maximum depth 17 ft. 9 in. (5.41 m.).

Tail Unit.—Cantilever monoplane type. Fin and tail-plane metal-covered. The movable surfaces are fabric-covered aft of the leading-edge and have inset trimming-tabs. Tailplane and elevator area 205 sq. ft. (19.04 sq. m.), Fin and rudder area 136 sq. ft. (21.9 sq. m.).

Power Plant.—Four 1,200 h.p. Pratt & Whitney R-1830-90B Twin Wasp fourteen-cylinder two-row radial air-cooled engines in NACA-type cowling rings with controllable flaps. Hamilton Standard three-blade constant-speed full-feathering metal airscrews, 12 ft. 9 in. (3.88 m.) diameter. Fuel tanks in wings with maximum capacity of 2,552 Imp. gallons (11,607 litres); oil capacity 138 Imp. gallons (628 litres).

Accommodation.—The hull is divided into two decks. On the upper deck, there is forward, the control cabin accommodating two pilots side-by-side, a radio operator, a navigator and an engineer. Aft of the spar frames are the reconnaissance flares and stowage for maintenance cradles. In the extreme nose is the bomb-aimer's position and nose gun-turret. This turret slides aft to permit easy mooring. Aft of the turret on the lower deck is the mooring compartment, from which a ladder leads to the upper deck. On



The Short Sunderland V General Reconnaissance Flying-boat (four 1,200 h.p. Pratt & Whitney Twin-Wasp engines).

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the starboard side of the ladder is the lavatory, while on the port side a gangway leads to the officers' wardroom. Further aft is the galley, bomb compartment, and crew's quarters. In the rear end of the hull is the work bench, the collapsible dinghy, flares and sea-markers.

ARMAMENT.—Ten 0.303 in. (7.9 m/m.) machine-guns in three Fraser-Nash turrets, one in nose, one amidships and one in extreme tail, the nose and tail turrets each being armed with four guns. Two .5 in. (12.7 m/m.) manually-operated beam guns. Bombs, depth-charges, etc., carried on railed racks which may be wound out from interior of hull to underside of wings inboard of engine nacelles.

DIMENSIONS.—Span 112 ft. 9½ in. (34.39 m.), Length 85 ft. 4 in. (26 m.), Height (to top of fin) 32 ft. 10½ in. (10 m.).

WEIGHTS AND LOADINGS.—Weight empty 37,000 lbs. (16,783 kg.), Removable equipment 5,205 lbs. (2,361 kg.), Fuel and oil 13,875 lbs. (6,293 kg.), Crew 7,000 lbs. (3,175 kg.), Bomb load 1,920 lbs. (870 kg.), Maximum take-off weight loaded 65,000 lbs. (29,482 kg.), Wing loading (fully loaded) 38.5 lbs./sq. ft. (188 kg./sq. m.), Power loading (fully loaded) 13.5 lbs./h.p. (6.1 kg./h.p.).

PERFORMANCE.—Maximum speed 213 m.p.h. (343 km.h.) at 5,000 ft. (1,525 m.), Economic cruising speed 117 m.p.h. (118 km.h.) at 12,250 ft. (3,735 m.), Rate of climb at sea level 840 ft./min. (256 m./min.), Service ceiling 17,900 ft. (5,455 m.), Still-air range (at 115 m.p.h.=185 km.h. at 2,000 ft.=915 m.) 1,842 miles (2,964 km.), Still-air range (at 128 m.p.h.=206 km.h. at 2,000 ft.=915 m.) 2,044 miles (3,290 km.).

THE SHORT S-25 CIVIL SUNDERLAND.

A number of Short Sunderlands was supplied to the British Overseas Airways Corpn. during the war to augment their fleet of oversea transports and were known as the *Hythe* class. Gun turrets and all associated military equipment was removed and the interior refitted to meet airline requirements. They are fitted with Bristol Pegasus 38 engines.

ACCOMMODATION.—Crew's quarters on forward upper deck as for Sunderland. Lower deck adapted to seat 16 day and night passengers (Type H.2), or 22 day passengers (Type H.3) retaining the galley as for the military version. Additional lavatory accommodation. Stowages for three extra dinghies and lashing points for the carriage of freight.

WEIGHTS.—Weight empty 33,190 lbs. (15,070 kg.), Fuel (2,160 Imp. gallons=9,826 litres) 15,552 lbs. (7,060 kg.), Oil (120 Imp. gallons=546 litres) 1,080 lbs. (490 kg.), Crew of six 1,020 lbs. (463 kg.), Pay load 4,158 lbs. (1,887 kg.), Weight loaded 55,000 lbs. (24,970 kg.).

PERFORMANCE.—As Sunderland.

THE SHORT NIMBUS.

The Nimbus is a projected two-seat low-gull-wing sailplane intended for instruction and aerobatics. It is to have a wooden monocoque fuselage of oval cross-section, and the wing will be a wooden single-spar structure with constant taper in chord and thickness, and with the centre-section set at an acute dihedral angle to the fuselage. The tail-unit is a cantilever monoplane structure, and the landing gear will consist of a skid under the fuselage and a single wheel. An enclosed cabin in the nose accommodates the crew of two in tandem.

DIMENSIONS.—Span 62 ft. (18.90 m.), Length 26 ft. 10 in. (8.18 m.), Wing area 240 sq. ft. (22.29 sq. m.), Aspect ratio 16.

WEIGHT AND LOADING (Designed).—Weight loaded 850 lbs. (386 kg.), Wing loading 3.58 lbs./sq. ft. (0.73 kg./sq. m.).

PERFORMANCE (Estimated).—Maximum diving speed 135 m.p.h. (217 km.h.), Stalling speed 30 m.p.h. (48 km.h.), Best gliding angle 1 : 25.8 at 37.6 m.p.h. (60 km.h.), Minimum sinking speed 2 ft./second (0.61 m./second) at 35 m.p.h. (56 km.h.).

SHORT & HARLAND.

SHORT & HARLAND, LTD.

HEAD OFFICE AND WORKS: QUEEN'S ISLAND, BELFAST, NORTHERN IRELAND.

General Manager: W. Browning.

Short & Harland, Ltd., was formed in Belfast in June, 1936, as the result of an agreement between Short Bros. (Rochester and Bedford), Ltd., and Harland & Wolff, Ltd. the well-known shipbuilders, to form a new company to build both land and marine aircraft in Belfast.

Work began with the production of 50 Bristol Bombay troop-carriers and 150 Handley Page Hereford bombers. After these contracts had been fulfilled the Company assumed production of Stirlings (in 1940) and Sunderlands (in 1942), 1,193 and 10 of which respectively were delivered up to the end of September 1945.

In addition Short & Harland were also engaged in extensive repair and conversion work, including the conversion of 51 Sunderland IIIs into Mk. Vs, and in 1945 began the modification of 180 Avro Lancasters for civilian use. Other conversion work includes the modification of Junkers Ju 52/3ms for British European Airways and the fitting-out of Handley Page Halifaxes as Halton airliners for British Overseas Airways. Three Sandringham IVs have been converted from Sunderlands for Tasman Empire Airways.

SUPERMARINE.

VICKERS-ARMSTRONGS, LTD.

WORKS: HURSLEY PARK, WINCHESTER, HANTS, AND SOUTH MARSTON, SWINDON, WILTS.

LONDON OFFICE: VICKERS HOUSE, BROADWAY, WESTMINSTER, S.W.1.

Directors: See under "Vickers-Armstrongs."

Managing Director: Major H. R. Kilner, M.C.

General Manager: B. W. A. Dickson.

Chief Engineer (Aircraft Section): R. K. Pierson, C.B.E., B.Sc., A.M.I.C.E., F.R.Ae.S.

Chief Designer (Supermarine Division): J. Smith, C.B.E., F.R.Ae.S., A.M.I.A.E.

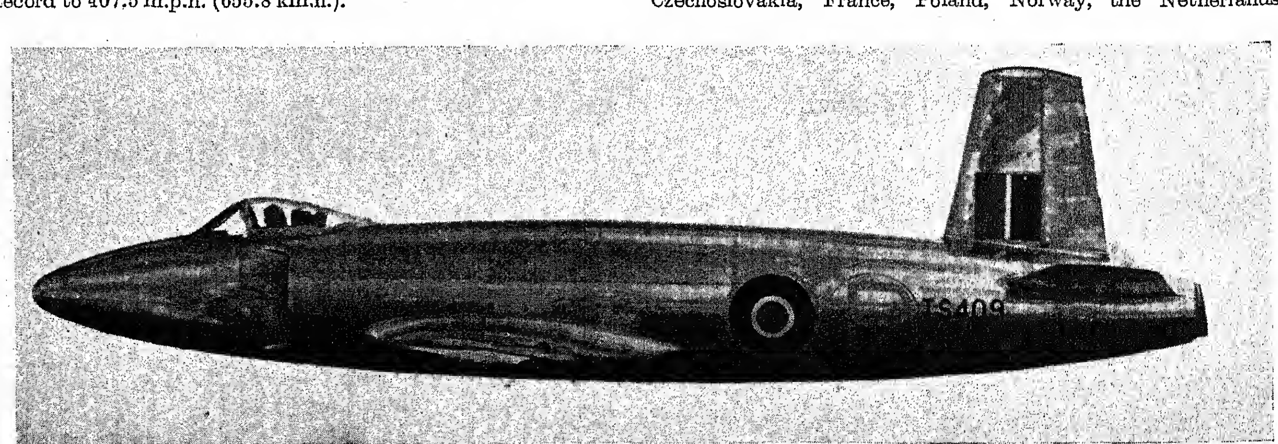
The original Supermarine Company was formed in 1912 and its efforts were chiefly devoted to the production of sea-going aircraft. The firm is famous for the design and production of the high-speed seaplanes which were successful in the Schneider Trophy Contests of 1922, 1927, 1929 and 1931, and ultimately won the Trophy outright for Great Britain. They were also responsible for several World's Speed Records, and the last was made on September 29, 1931, when the winning S.6B, fitted with a special Rolls-Royce "sprint" engine raised the Record to 407.5 m.p.h. (655.8 km.h.).

In November, 1928, Vickers (Aviation), Ltd. took over the control of the Supermarine Aviation Works, Ltd. In October, 1938, the Supermarine Aviation Works (Vickers), Ltd., was, with its parent company Vickers (Aviation), Ltd., taken over by Vickers-Armstrongs, Ltd.

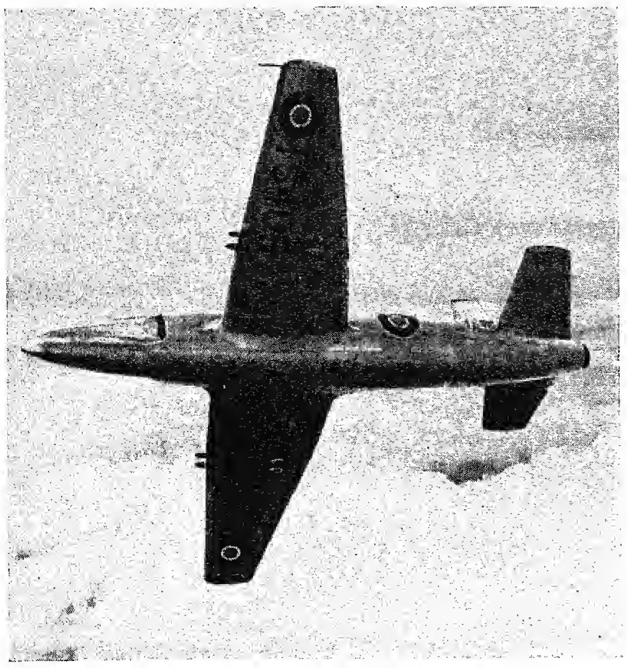
The Company's first landplane to go into production was the Spitfire, the single-seat fighter which first flew in 1936 and which immediately attained the foremost position among fighter aircraft, a position which it held in its various forms right through the war. The latest versions, the Mks. 21, 22 and 24, are still among the fastest airscrew-driven aircraft.

In six years of war the power of the Spitfire increased by 100%, its weight by 40%, its maximum speed by 35% and its rate of climb by 80%. Total production of the Spitfire, of which some twenty-nine different versions were built during the war, amounted to 21,000, including naval Seafires and 305 Spitfires built before the war.

The Spitfire operated in most overseas theatres of war, including Italy, Malta, the Middle East, India and Australia. Apart from being a standard fighter type in the R.A.F. and the Dominion Air Forces, it was also used by the Air Forces of Czechoslovakia, France, Poland, Norway, the Netherlands,



The Supermarine E.10/44 Single-seat Fighter (Rolls-Royce Nene I turbo-jet engine).—(*Charles Brown*).



The Supermarine E.10/44 Single-seat Fighter.

Jugoslavia, Belgium, Russia and the United States. Over 700 Spitfires were supplied to the U.S. Army Air Forces under reverse Lend/Lease.

The naval version of the Spitfire, known as the Seafire, went into service with the Fleet Air Arm in 1942. The latest versions are the Mks. 45, 46 and 47.

On the marine side, the Walrus boat amphibian, which was originally adopted by the Admiralty as standard equipment for all catapult-equipped ships in 1936, was still in production during the first years of the war and was in service throughout the war on Air/Sea Rescue duties. The Walrus was last described in the 1945-46 issue of this Annual.

The Sea Otter is a development of the Walrus. It was designed for duties similar to those of its predecessor and latterly was also employed on Air/Sea Rescue duties both in home and Far Eastern waters. It is now available for civilian use.

The S.14/44 is a projected amphibian aircraft designed as a replacement type for the Sea Otter.

A development of the Spitfire, the Spiteful (and its naval equivalent, the Seafang) was produced just too late to be operated during the war, but is now in service.

The Company's latest development is a single-seat jet-propelled fighter monoplane produced to Specification E.10/44. This aircraft is powered by a Rolls-Royce Nene I turbo-jet engine and is among the fastest aircraft flying.

THE SUPERMARINE E.10/44.

The latest Supermarine design is a single-seat jet-propelled fighter monoplane conforming to Specification E.10/44. The prototype made its first flight on July 27, 1946. This aircraft is unusual in that it is fitted with a two-wheel landing-gear, allowing a tail-down position on the ground, whereas all previous jet-propelled aircraft have had tricycle landing gears.

Type.—Single-seat jet-propelled Fighter.

Wings.—Cantilever low-mid-wing monoplane. High-speed laminar-flow aerofoil section. All-metal structure with straight-tapered wings and square-cut tips. All-metal balanced ailerons with controllable trim-tab in each. All-metal split trailing-edge flaps between ailerons and fuselage. Wing area 226 sq. ft. (21 sq. m.).

Fuselage.—All-metal structure of circular cross-section. Forward portion is of heavy structure to afford armour protection for pilot.

Tail Unit.—Cantilever monoplane type. All-metal structure with forwardly-placed fin and rudder. Dihedral tailplane. Balanced rudder and elevators of metal construction with metal covering over all surfaces. Controllable trim-tabs and balance tabs in elevators and rudder.

Landing Gear.—Retractable two-wheel type. Each main wheel carried on inside of shock-absorber leg with side bracing strut retracts inwards into wing and is enclosed by fairing plates attached to legs and by hinged doors under wing. Twin tail-wheels retract into fuselage and are enclosed by twin doors.

Power Plant.—One Rolls-Royce R.B. 41 Nene I centrifugal-flow turbo-jet engine producing a static thrust of 5,000 lbs. (2,266 kg.) mounted in fuselage aft of cockpit and exhausting from circular outlet in extreme stern. Intakes in sides of fuselage below cockpit. Fuel capacity 310 Imp. gallons (1,409 litres) in internal tanks in fuselage, and provision for 270 Imp. gallon (1,227 litres) drop-tank.

Accommodation.—Pilot's pressurized cockpit mounted well forward ahead of wing leading-edge, with moulded canopy which slides for access. Cordite-operated emergency-ejection seat.

Armament.—Four 20 m/m. British Hispano cannon mounted two in each wing.

Dimensions.—Span 36 ft. 11 in. (11.26 m.), Length 27 ft. 6 in. (11.44 m.), Height (over rudder, tail down) 9 ft. 11 in. (3.02 m.).

Weights and Performance.—No data available.

THE SUPERMARINE SPITEFUL.

The Spiteful was designed to Specification F.1/43, and is a direct descendant of the Spitfire. It retains the general characteristics of its predecessor, but is in fact a completely new design with many new and distinctive features. These include straight-tapered wings with square tips; larger tailplane and fin and rudder; a wide-track inwardly-retracting landing gear; wider and shallower radiator ducts under the wings, and the fuselage is of more streamlined form. There are two versions of the Spiteful: the F. Mk. XIV with a Rolls-Royce Griffon 69 engine driving a Rotol five-blade airscrew, and the F. Mk. XV with the 1,540 h.p. Griffon 89 or 90 engine driving two Rotol three-blade contra-rotating co-axial airscrews.

The following specification applies to the Mk. XIV.

Type.—Single-seat Fighter or Fighter-Bomber.

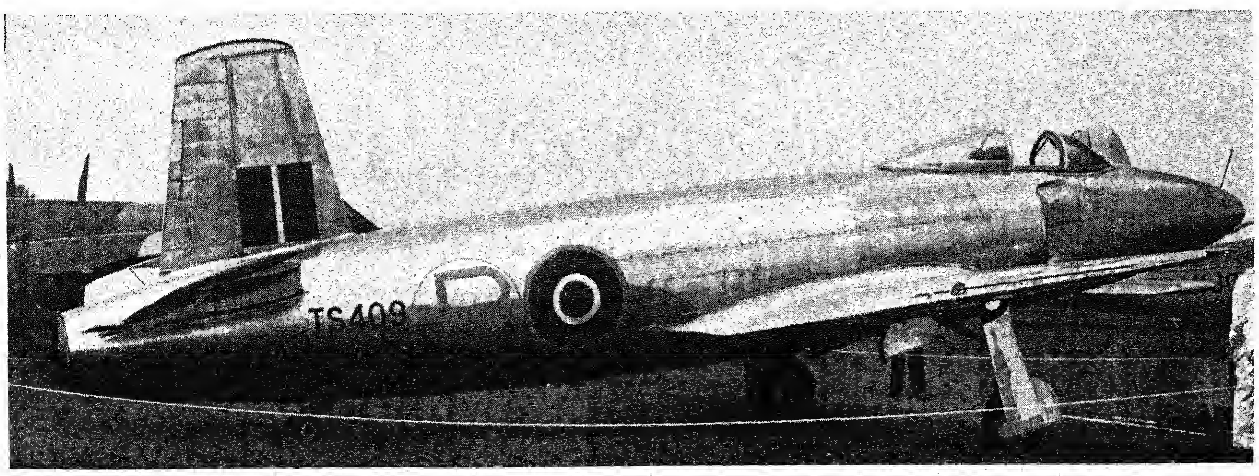
Wings.—Cantilever low-wing monoplane. Supermarine high-speed laminar-flow aerofoil section. Two-spar structure in two main sections attached to sides of fuselage, and detachable tips. Stressed metal skin. All-metal ailerons with controllable trim-tab in each. Hydraulically-operated split trailing-edge flaps between ailerons and fuselage. Wing area 210 sq. ft. (19.51 sq. m.).

Fuselage.—All-metal monocoque structure of oval cross-section consisting of two main longerons forward, transverse frames, longitudinal stringers and stressed metal skin.

Tail Unit.—Cantilever monoplane type. Metal structure with metal covering over all surfaces. Balanced rudder and elevators, with controllable trim-tab in each. Tailplane span (overall) 12 ft. 10 in. (3.91 m.); maximum tailplane and elevator chord 4 ft. 1 in. (1.24 m.).

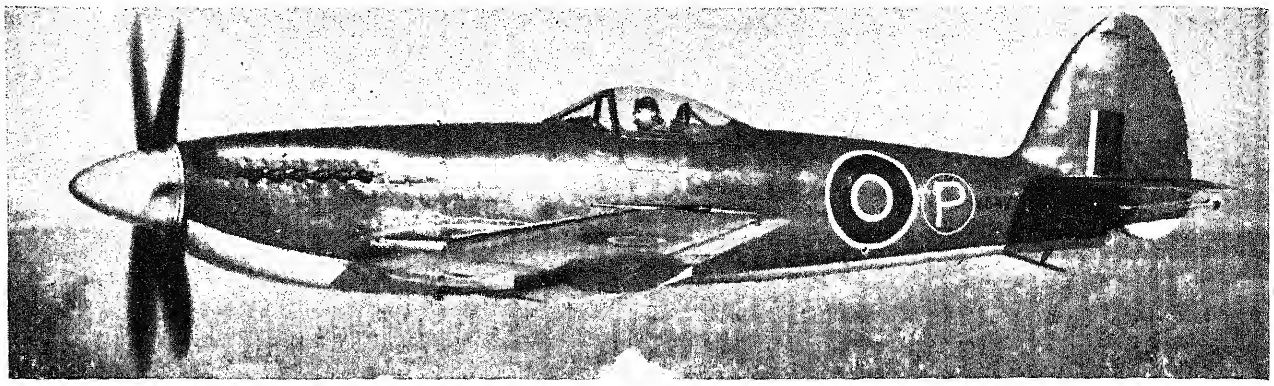
Landing Gear.—Retractable two-wheel type. Each main wheel carried on inside of single shock-absorber leg with side bracing strut retracts inwards into wing and is completely enclosed by fairing plates attached to the legs and by hinged doors under fuselage. Hydraulic operation. Track 12 ft. 5½ in. (3.80 m.). Pneumatic brakes on main wheels. Tailwheel retracts rearwards into fuselage and is enclosed by twin doors.

Power Plant.—One Rolls-Royce Griffon 69 twelve-cylinder vee liquid-cooled engine rated at 1,490 h.p. at 2,600 r.p.m. at 13,500 ft. (4,115 m.) with 9 lbs./sq. in. (0.63 kg./sq. c/m.) boost in M.S. gear; 2,145 h.p. at 2,750 r.p.m. at 16,000 ft. (4,875 m.) with 25 lbs./sq. in. (1.76 kg./sq. c/m.) boost in F.S. gear; a maximum output of 2,375 h.p. at 2,750 r.p.m. at 1,250 ft. (380 m.) with 25 lbs./sq. in. (1.76 kg./sq. c/m.) boost in M.S. gear, and a take-off power of 1,520 h.p.



The Supermarine E.10/44 Single-seat Jet-propelled Fighter (Rolls-Royce Nene engine).

***SUPERMARINE**—continued.*



The Supermarine Seafang 31 Single-seat Fleet Fighter, the naval version of the Spiteful XIV.

at 2,750 r.p.m. with 12 lbs./sq. in. (0.84 kg./sq. c/m.) boost. Two-speed two-stage supercharger. Rotol five-blade constant-speed airscrew, 11 ft. 0 in. (3.35 m.) diameter. Fuel capacity 178 Imp. gallons (809 litres) in armoured or self-sealing fuselage tanks, and provision for 90 Imp. gallon (409 litre) or 180 Imp. gallon (818 litre) auxiliary drop-tank. Oil tank of 9½ Imp. gallons (43 litres) capacity in decking aft of engine. Cartridge starter.

ACCOMMODATION.—Pilot's cockpit aft of trailing-edge of wing has fixed bullet-proof windscreen and bubble-type canopy which slides backwards for access.

ARMAMENT.—Four 20 m/m. British Hispano cannon mounted two in each wing outside airscrew disc, with 167 rounds for each inner and 145 rounds for each outer gun. Racks under wings for 2 × 1,000 lb. (454 kg.) bombs or 4 × 300 lb. (136 kg.) rocket projectiles.

EQUIPMENT.—24-volt electric system charged by 1,000-watt engine-driven generator. Radio, oxygen and windscreen de-icing equipment. Camera-gun.

DIMENSIONS.—Span 35 ft. 0 in. (10.67 m.), Length 32 ft. 11 in. (10.04 m.), Height (over airscrew, tail down) 13 ft. 5 in. (4.09 m.), Height (overall, tail up) 12 ft. 11 in. (3.94 m.).

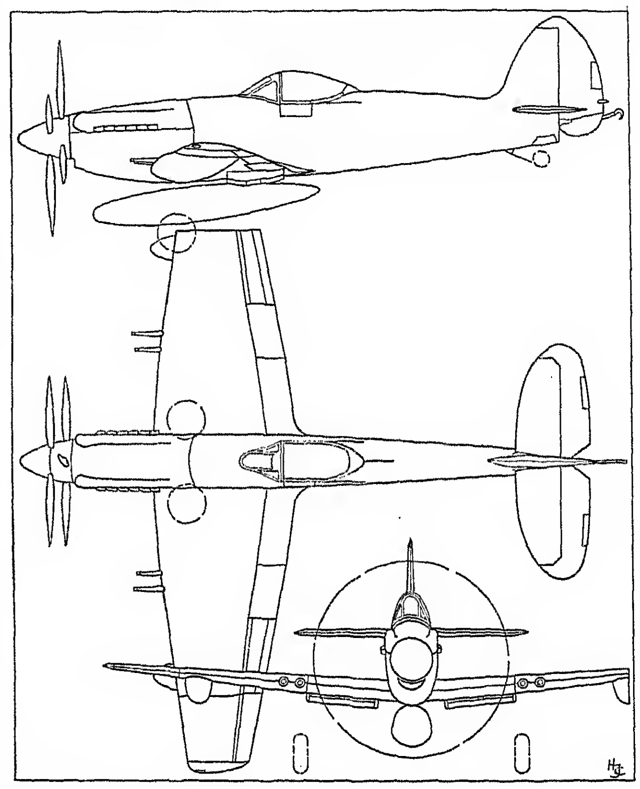
WEIGHTS AND LOADINGS.—Weight empty 7,350 lbs. (3,337 kg.), Normal weight loaded 9,950 lbs. (4,517 kg.), Maximum weight loaded with long-range tanks, 11,400 lbs. (5,176 kg.). Wing loading (normal) 47.4 lbs./sq. ft. (231.5 kg./sq. m.), Power loading 4.19 lbs./h.p. (1.87 kg./CV).

PERFORMANCE.—Maximum speed 483 m.p.h. (777 km.h.) at 26,000 ft. (7,930 m.), Speed at 5,500 ft. (1,675 m.) 437 m.p.h. (703 km.h.), Speed at sea level 409 m.p.h. (658 km.h.), Maximum rate of climb 4,890 ft./min. (1,491 m./min.) at 2,000 ft. (610 m.), Rate of climb at sea level 4,828 ft./min. (1,473 m./min.), Rate of climb at 22,000 ft. (6,710 m.) 3,106 ft./min. (947 m./min.), Service ceiling 42,000 ft. (12,810 m.), Normal range 564 miles (907 km.) at 240-255 m.p.h. (386-410 km.h.) at 20,000 ft. (6,095 m.), Maximum range with 180 Imp. gallon (818 litre) drop-tank, 1,315 miles (2,115 km.) at 240-260 m.p.h. (386-418 km.h.) at 20,000 ft. (6,095 m.), Take-off distance to 50 ft. (15 m.) in 5 m.p.h. (8 km.h.) wind 840 yds. (768 m.), Landing distance from 50 ft. (15 m.) in 5 m.p.h. (8 km.h.) wind 740 yds. (676 m.).

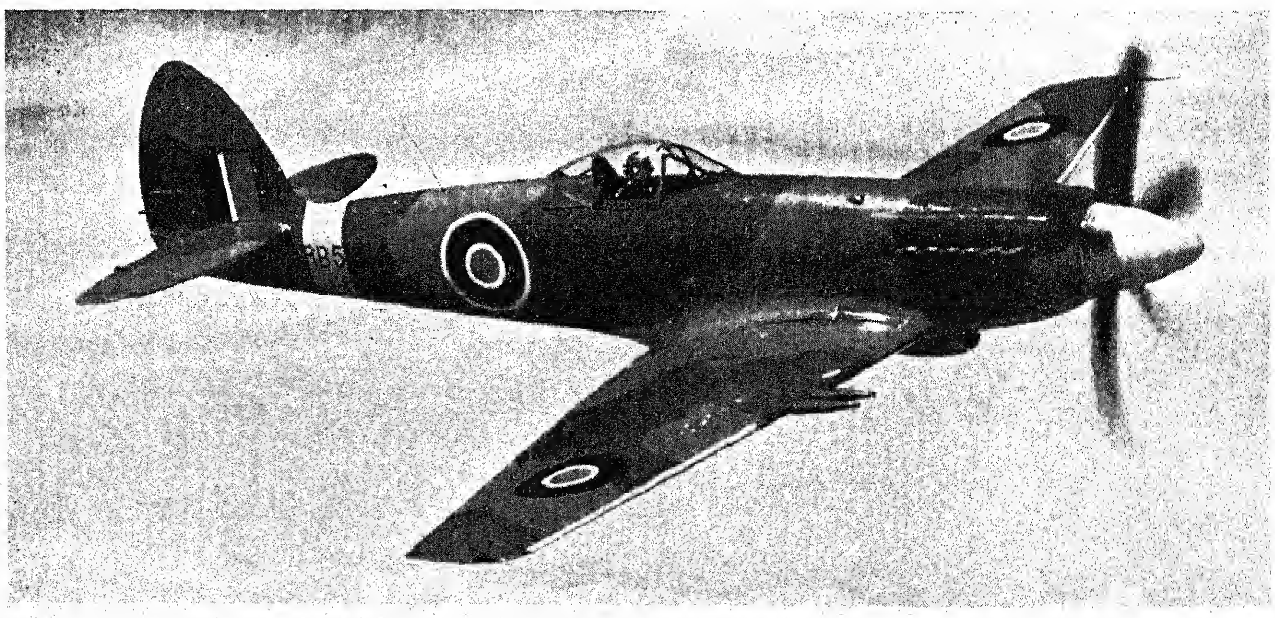
THE SUPERMARINE SEAFANG.

The Seafang is a naval adaptation of the Spiteful and conforms to Specification N.5/45. Structurally the two types are identical.

There are two versions of the Seafang: the F. Mk. 31, which is virtually a hooked Spiteful with a Rolls-Royce Griffon 69 engine driving a Rotol five-blade airscrew and non-folding-wings, and the F. Mk. 32, the production version with folding wings, increased tankage, and a Griffon 89 engine driving Rotol

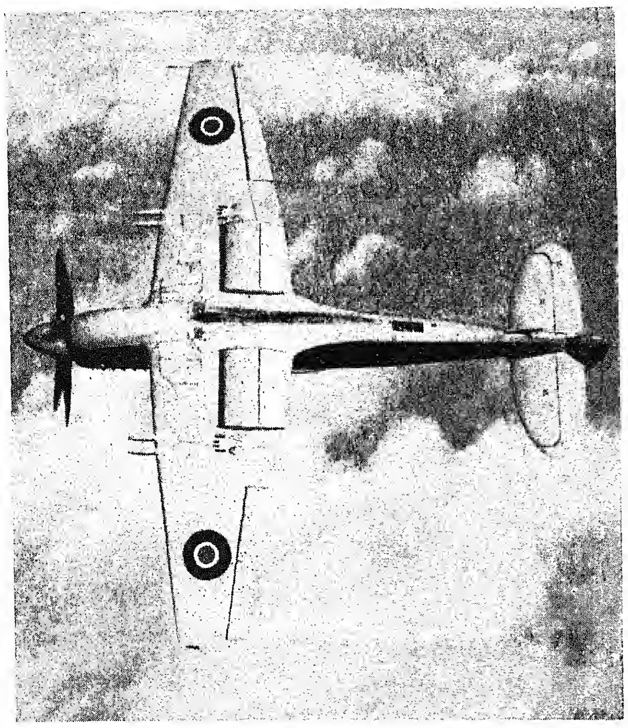


The Supermarine Seafang 32 Fleet Fighter.



The Supermarine Spiteful XIV Single-seat Fighter (2,375 h.p. Rolls-Royce Griffon 69 engine).—*(Charles Brown).*

***SUPERMARINE**—continued.*



The Supermarine Seafang 31 Fleet Fighter.—(*Charles Brown*).

three-blade contra-rotating airscrews. The following specification applies to the Mk. 32.

TYPE.—Single-seat Carrier-borne Fighter.

WINGS.—Structure as Spiteful, except that outer wings fold upwards at a point approximately 4 ft. 6 in. (1.37 m.) from tips. Hydraulic operation.

FUSELAGE AND TAIL UNIT.—As Spiteful.

LANDING GEAR.—As Spiteful, with addition of sting-type deck-arrester hook in lower portion of rudder.

POWER PLANT.—One Rolls-Royce Griffon 89 twelve-cylinder vee liquid-cooled engine rated at 1,490 h.p. at 2,600 r.p.m. at 13,500 ft. (4,120 m.) with 9 lbs./sq. in. (0.56 kg./sq. c/m.) boost in M.S. gear, 2,145 h.p. at 2,750 r.p.m. at 16,000 ft. (4,880 m.) with 25 lbs./sq. in. (1.76 kg./sq. c/m.) boost in F.S. gear; a maximum output of 2,375 h.p. at 2,750 r.p.m. at 1,250 ft. (380 m.) with 25 lbs./sq. in. (1.76 kg./sq. c/m.) boost, in M.S. gear, and a take-off power of 1,935 h.p. at 2,750 r.p.m. with 18 lbs./sq. in. (1.26 kg./sq. c/m.) boost in M.S. gear. Two-speed two-stage supercharger. Two Rotol three-blade contra-rotating co-axial metal airscrews, 11 ft. 0 in. (3.35 m.) diameter. Fuel capacity 153 Imp. gallons (696 litres) in fuselage tanks; combat tank of 45 Imp. gallons (205 litres) and provision for combination of 90 Imp. gallons (409 litre) auxiliary drop-tank under fuselage, and two 22½ Imp. gallon (102 litre) wing-tanks, or a single 180 Imp. gallon (818 litre) drop-tank under fuselage.

ACCOMMODATION AND ARMAMENT.—As Spiteful.

EQUIPMENT.—As Spiteful, plus provision for R.A.T.O.G., and lashing-down and slinging points.

DIMENSIONS.—Span 35 ft. 0 in. (10.67 m.), Width folded 27 ft. 0 in. (8.24 m.), Length 34 ft. 1 in. (10.40 m.), Height (over airscrew, tail down) 12 ft. 6 in. (3.83 m.), Height over folded wings (tail down) 9 ft. 7 in. (2.92 m.).

WEIGHTS AND LOADINGS.—Weight empty 8,000 lbs. (3,632 kg.), Weight loaded (normal) 10,450 lbs. (4,744 kg.), Weight loaded with 180 Imp. gallon (818 litre) drop-tank 11,900 lbs. (5,402 kg.), Wing loading (normal) 49.8 lbs./sq. ft. (243 kg./sq. m.), Power loading 4.40 lbs./h.p. (1.97 kg./CV).

PERFORMANCE.—Maximum speed 475 m.p.h. (764 km.h.) at 21,000 ft. (6,405 m.), Speed at 26,000 ft. (7,930 m.) 472 m.p.h. (759 km.h.), Speed at sea level 397 m.p.h. (639 km.h.), Maximum rate of climb 4,630 ft./min. (1,412 m./min.) up to 2,000 ft. (610 m.), Rate of climb at 22,000 ft. (6,710 m.) 2,180 ft./min. (970 m./min.), Service ceiling 42,000 ft. (12,810 m.), Normal range 393 miles (632 km.) at 220-240 m.p.h. (354-386 km.h.) at 20,000 ft. (6,095 m.), Maximum range with 180 Imp. gallon (818 litre) drop-tank 1,120 miles (1,802 km.) at 20,000 ft. (6,095 m.), Take-off run from deck in 30 m.p.h. (48 km.h.) wind 152 yds. (139 m.).

THE SUPERMARINE SPITFIRE.

The first Supermarine aeroplane to bear the name Spitfire was an experimental single-seat fighter designed to Specificaton F.7/30. It was produced in 1934, and was a cantilever low-wing monoplane with inverted gull wings and a fixed landing gear. The power plant was a 600 h.p. Rolls-Royce Goshawk steam-cooled engine. From this type, which did not proceed beyond the prototype stage, was evolved as a Private Venture a new prototype to which the name Spitfire was transferred and around which Specification F.37/34 was written. Into this aircraft the late Mr. R. J. Mitchell incorporated the fruitful results of the experience gained in the design of his series of high-speed seaplanes which won the Schneider Trophy for Great Britain and established three World's Speed Records.

The prototype F.37/34, fitted with one of the first Rolls-Royce Merlin engines, flew in March, 1936. With a fixed-pitch wooden airscrew it had a maximum speed of 342 m.p.h. (547 km.h.), which classed it at the time as the fastest military aeroplane in the World. The soundness of the basic design was proved in six years of war, throughout which the Spitfire, in its many progressive developments, remained a first-line fighter. Apart from its fighter and fighter-bomber duties the Spitfire was also used during the whole of the belligerent period for photographic-reconnaissance duties. The first photographic mission by an unarmed Spitfire was made on November 18, 1939.

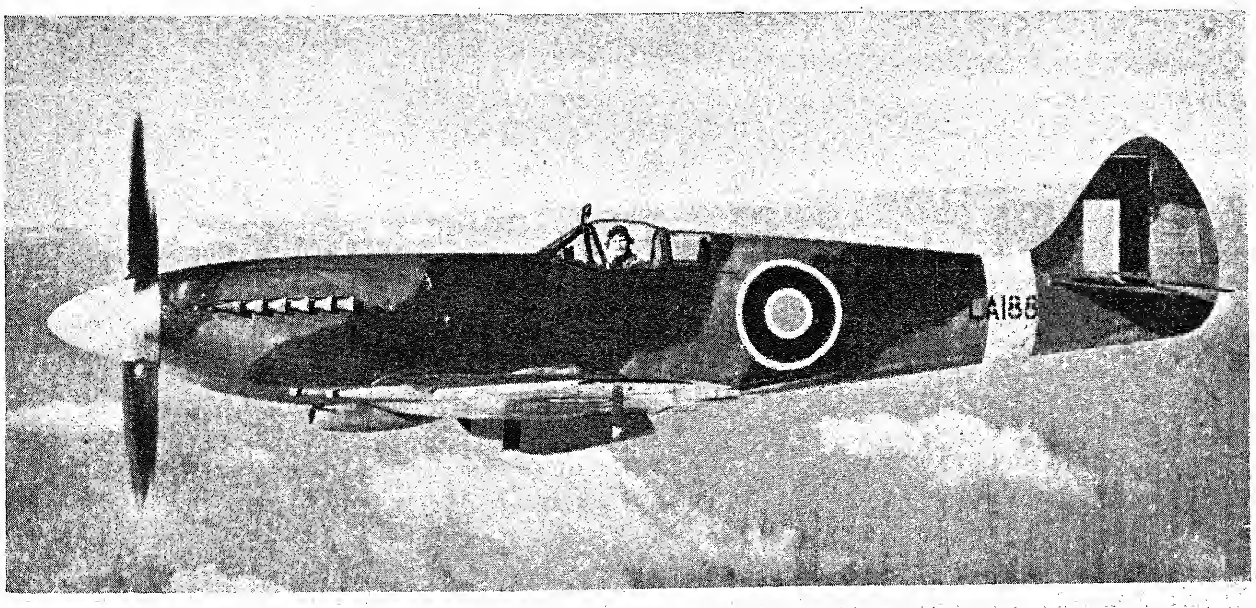
Details of the many variations of the Spitfire were given in the last issue of "All the World's Aircraft." The current versions are the Mks. 21, 22 and 24, although many of the other marks are still flying on various duties.

The Mk. 21 constituted the first major structural change in the Spitfire, although the characteristic streamlined shape was not lost. The wings were redesigned to have square-cut tips, and the tail surfaces were modified. The Mk. 22 is similar but is fitted with a bubble-type cockpit cover which necessitated a redesign of the rear fuselage. The Mk. 24 is a strengthened version of the Mk. 22. The following description applies specifically to the Mk. 22.

TYPE.—Single-seat Fighter.

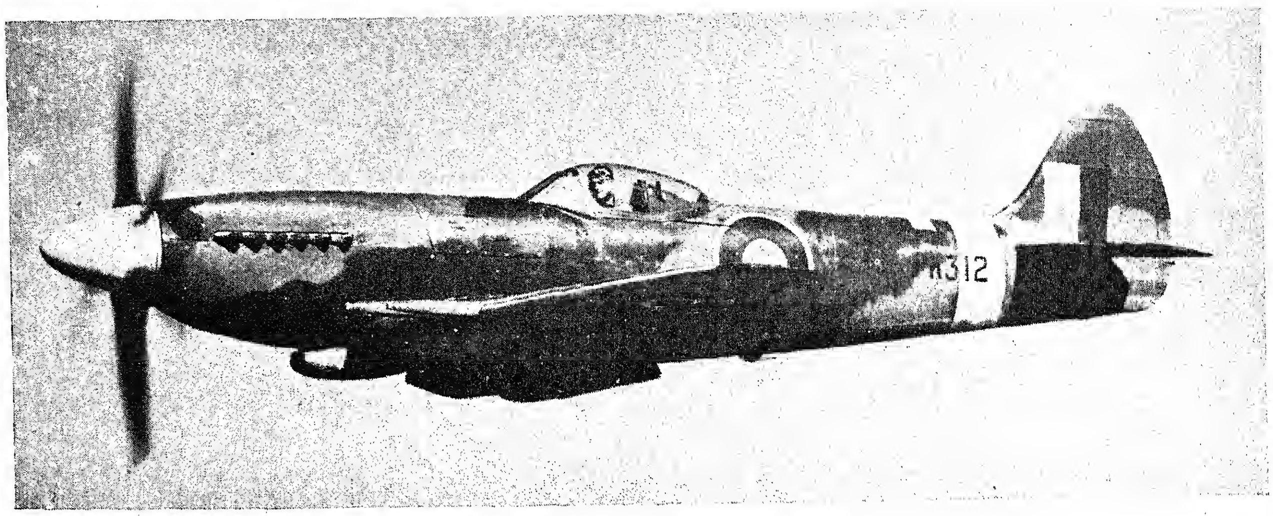
WINGS.—Cantilever low-wing monoplane. Two-spar light-alloy structure in two main sections attached to stub spar booms. Detachable tips. Main spar of built-up I-section, and swept-forward rear spar carrying control surfaces. Built-up chord-wise ribs and diaphragms, with stressed light-alloy skin. Mean aerodynamic chord 7 ft. 2.3 in. (2.19 m.). Wing area 243.6 sq. ft. (22.63 sq. m.). All-metal balanced ailerons with controllable trim-tab in each. All-metal split trailing-edge flaps between ailerons and fuselage in two sections each side. Hydraulic operation.

FUSELAGE.—Oval-section all-metal monocoque structure in three main sections consisting of engine section; main fuselage, and tail-end bolted together. Main section has four main longerons, and heavy longitudinal member at top, pressed transverse frames and longitudinal stringers, with stressed light-alloy skin.



The Supermarine Spitfire 21 Single-seat Fighter (Rolls-Royce Griffon 61 engine).

***SUPERMARINE**—continued.*



The Supermarine Spitfire 22 Single-seat Fighter (Rolls-Royce Griffon 61 engine).

Tail Unit.—Cantilever monoplane type. All-metal structure with metal covering over fin and tailplane and fabric-covered rudder and elevators. Fin integral with rear fuselage section. Balanced rudder and elevators with controllable trim-tab in each. Tailplane span (overall) 12 ft. 10 in. (3.91 m.); maximum tailplane and elevator chord 4 ft. 1 in. (1.24 m.).

Landing Gear.—Retractable two-wheel type. Each main wheel carried on single Vickers cantilever oleo-pneumatic shock-absorber leg retracts outwards into wing and is enclosed by fairing plates attached to legs and by hinged doors under wing. Hydraulic operation, with emergency-lowering gear. Track 6 ft. 8 in. (2.03 m.). Tail-wheel carried in fork on shock-absorber leg retracts rearwards into fuselage and is enclosed by twin doors.

Power Plant.—One Rolls-Royce Griffon 61, 64 or 85 twelve-cylinder vee liquid-cooled engine rated at 1,490 h.p. at 2,600 r.p.m. at 13,500 ft. (4,120 m.) with 9 lbs./sq. in. (0.64 kg./sq. c/m.) boost in M.S. gear; 2,145 h.p. at 2,750 r.p.m. at 16,000 ft. (4,880 m.) with 25 lbs./sq. in. (1.76 kg./sq. c/m.) boost in F.S. gear; a maximum output of 2,375 h.p. at 2,750 r.p.m. at 1,250 ft. (380 m.) with 25 lbs. /sq.in. (1.76 kg./sq. c/m.) boost in M.S. gear, and a take-off power of 1,520 h.p. at 2,750 r.p.m with 12 lbs./sq. in. (0.84 kg./sq. c/m.) boost in M.S. gear. Two-speed two-stage supercharger. Rotol five-blade constant-speed airscrew, 11 ft. 0 in. (3.35 m.) diameter, with two three-blade contra-rotating airscrews optional. Fuel capacity 186 Imp. gallons (846 litres) in fuselage and port wing leading-edge, and provision for one 30 Imp. gallon (136 litre), 50 Imp. gallon (227 litre) or 90 Imp. gallon (409 litre) auxiliary drop-tank under fuselage. A 170 Imp. gallon (773 litre) tank can be fitted under the fuselage for ferrying purposes only. Oil tank of 9 Imp. gallons (41 litres) capacity aft of engine in fuselage decking. Cartridge starter.

Accommodation.—Pilot's cockpit in line with wing trailing-edge has three-panel bullet-proof windscreen and bubble-type canopy which slides for access.

Armament.—Four 20 m/m. British Hispano cannon mounted two in each wing outside airscrew disc with 175 rounds for each inner and 150 rounds for each outer gun. Provision for three bombs of up to 500 lbs. (227 kg.) each or rocket projectiles under wings and fuselage.

Equipment.—24-volt electric system. Oxygen, radio and wind-screen de-icing equipment. *Ciné*-camera in leading-edge of starboard wing root.

Dimensions.—Span 36 ft. 11 in. (11.26 m.), Length 32 ft. 11 in. (10.04 m.), Height (over airscrew, tail down) 13 ft. 6 in. (4.12 m.).

Weights and Loadings.—Weight empty 7,160 lbs. (3,251 kg.), Weight loaded (normal) 9,900 lbs. (4,495 kg.), Weight loaded with 170 Imp. gallon (773 litre) drop-tank, 11,290 lbs. (5,126 kg.), Wing loading (normal) 40.5 lbs./sq. ft. (198.6 kg./sq. m.), Power loading 4.17 lbs./h.p. (1.87 kg./CV).

Performance (Standard Mk. 22 with Rotol five-blade airscrew).—Maximum speed 450 m.p.h. (724 km.h.) at 19,600 ft. (5,980 m.), Speed at 25,000 ft. (7,625 m.) 449 m.p.h. (722 km.h.), Speed at sea level 390 m.p.h. (628 km.h.). Maximum rate of climb 4,900 ft./min. (1,495 m./min.), Rate of climb at 21,500 ft. (6,560 m.) 3,400 ft./min. (1,037 m./min.). Rate of climb at sea level 4,880 ft./min. (1,488 m./min.), Service ceiling 43,000 ft. (13,115 m.). Normal range 580 miles (933 km.) at 230-245 m.p.h. (270-394 km.h.) at 20,000 ft. (6,095 m.), Maximum range with 90 Imp. gallon (409 litre) drop-tank 965 miles (1,553 km.). Take-off distance to 50 ft. (15 m.) in 5 m.p.h. (8 km.h.) 700 yds. (641 m.), Landing distance from 50 ft (15 m.) 560 yds. (512 m.).

THE SUPERMARINE SPITFIRE TRAINER.

From the Spitfire single-seat fighter has been developed a two-seat version for advanced fighter training. The prototype is a conversion of a Mk. VIII fighter, and has a 1,325 h.p. Rolls-Royce Merlin 66 twelve-cylinder vee liquid-cooled engine driving a Rotol four-blade constant-speed airscrew, 11 ft. 0 in. (3.35 m.) diameter. Other marks may be similarly converted.

The front cockpit has been moved slightly forward, and is occupied by the pupil. A second cockpit is added behind, and the seat is raised slightly to afford a better view for the instructor over the pupil's head. Both cockpits are fitted with sliding covers which can be jettisoned.

Full dual controls are installed, together with full radio, navigation and oxygen equipment. Armament depends upon that originally fitted in the aircraft before conversion. The prototype has four .303 in. (7.9 m/m.) Browning machine-guns in the wings, the two cannon of the Spitfire VIII having been replaced by extra fuel tanks in the wings. Provision is made for the carriage of bombs, rocket projectiles and long-range drop-tanks.

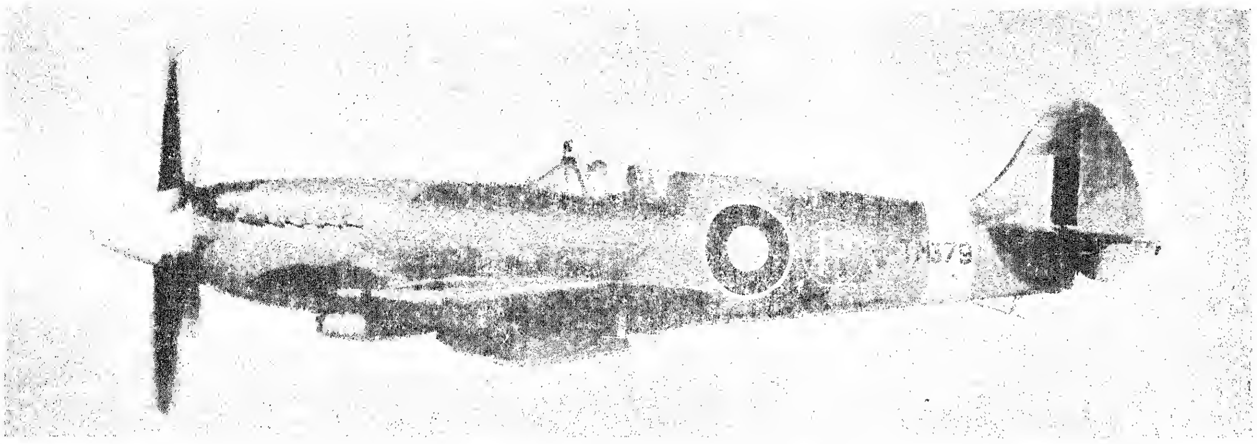
Dimensions.—Span 36 ft. 10 in. (11.22 m.), Length 31 ft. 4¼ in. (9.55 m.), Height (over rudder, tail down) 11 ft. 2¾ in. (3.43 m.), Gross wing area 242 sq. ft. (22.47 sq. m.).

Weights and Loadings.—Weight loaded 7,400 lbs. (3,357 kg.), Wing loading 30.5 lbs./sq. ft. (149 kg./sq. m.), Power loading 5.5 lbs./h.p. (2.48 kg./h.p.).

Performance. (Prototype)—Maximum speed 390 m.p.h. (628 km.h.) at 20,000 ft. (6,095 m.), Speed at 9,000 ft. (2,745 m.) 365 m.p.h. (587 km.h.), Stalling speed 80 m.p.h. (129 km.h.).

The Supermarine Spitfire Two-seat Advanced Trainer (1,325 h.p. Rolls-Royce Merlin 66 engine).—(*Charles Brown.*)

SUPERMARINE—*continued.*



The Supermarine Seafire 45 Single-seat Fleet Fighter (Rolls-Royce Griffon 61 engine).—(*Charles Brown.*)

THE SUPERMARINE SEAFIRE.

The Seafire is the naval version of the Spitfire specially adapted for operation from aircraft-carriers. It has folding wings and is provided with catapult, deck arrester gear and other specialised equipment. Many versions of the Seafire were built, and with the Navy they maintained the high standard of efficiency which the Spitfire had established. Details of the earlier marks were given in the 1945-46 edition of "All the World's Aircraft." The latest versions are the Seafire 45, 46 and 47. The Mk. 45 is powered by a Rolls-Royce Griffon 61 engine driving a Rotol five-blade airscrew, and is the naval equivalent of the Spitfire 21. The Seafire 46 is similar to the Mk. 45 but has a Spitfire 22 fuselage and a rear-view cockpit hood. It is powered by a Griffon 61 or 64 engine driving a Rotol five-blade airscrew, or a Griffon 87 engine and contra-rotating airscrews. The wings are non-folding. The Seafire 47 is the naval version of the Spitfire 22 previously described, and the following specification applies to this model.

TYPE.—Single-seat Carrier-borne Fighter.

WINGS.—Structure as Spitfire 22, except that wings fold upwards outboard of cannon. Hinges at top and lock at bottom of front spar; hinge only on rear spar. Manual operation. Jury strut secures wing in folded position. Wing area 246.6 sq. ft. (22.9 sq. m.).

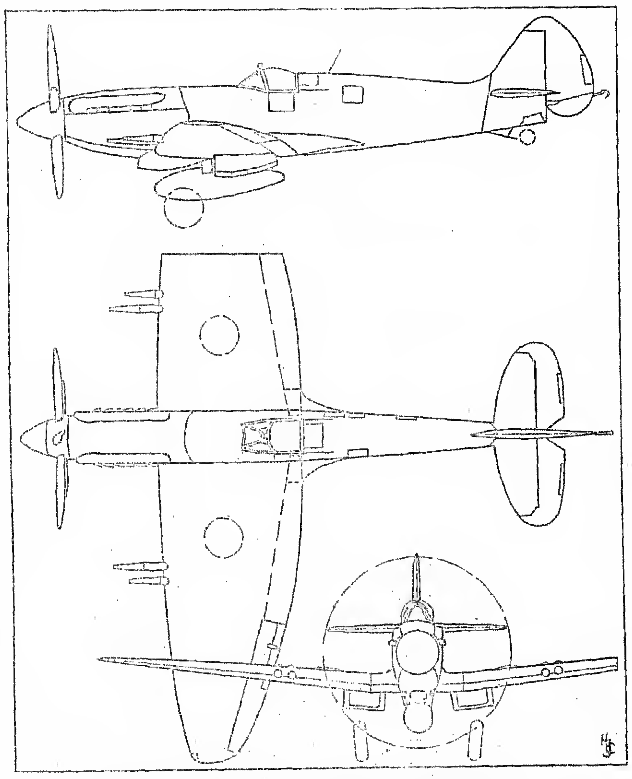
FUSELAGE AND TAIL UNIT.—As Spitfire 22.

LANDING GEAR.—As Spitfire 22 but strengthened and with long-stroke oleos. Sting-type deck arrester hook in lower portion of rudder.

POWER PLANT.—One Rolls-Royce Griffon 87 twelve-cylinder vee liquid-cooled engine rated at 1,490 h.p. at 2,600 r.p.m. at 13,500 ft. (4,120 m.) with 9 lbs./sq.in. (0.64 kg./sq. c/m.) boost in M.S. gear; 2,145 h.p. at 2,750 r.p.m. at 16,000 ft. (4,880 m.) with 25 lbs./sq. in. (1.76 kg./sq. c/m.) boost in F.S. gear; a maximum output of 2,375 h.p. at 2,750 r.p.m. at 1,250 ft. (380 m.) with 25 lbs. /sq.in. (1.76 kg./sq. c/m.) boost in M.S. gear, and a take-off power of 1,935 h.p. at 2,750 r.p.m. with 18 lbs./sq. in. (1.26 kg./sq. c/m.) boost in M.S. gear. Two-speed two-stage supercharger. Two Rotol three-blade constant-speed contra-rotating co-axial airscrews, 11 ft. 0 in. (3.35 m.) diameter. Fuel capacity 153 Imp. gallons (696 litres) plus 45 Imp. gallons (204.5 litres) in wing combat tanks, and provision for 30 Imp. gallon (136 litre), 50 Imp. gallon (227 litre) or 90 Imp. gallon (409 litre) auxiliary drop-tank under fuselage. A single 170 Imp. gallon (773 litre) tank can be carried under the fuselage for ferrying purposes only. Oil tank of 9 Imp. gallons (41 litres) capacity aft of engine in fuselage decking. Cartridge starter.

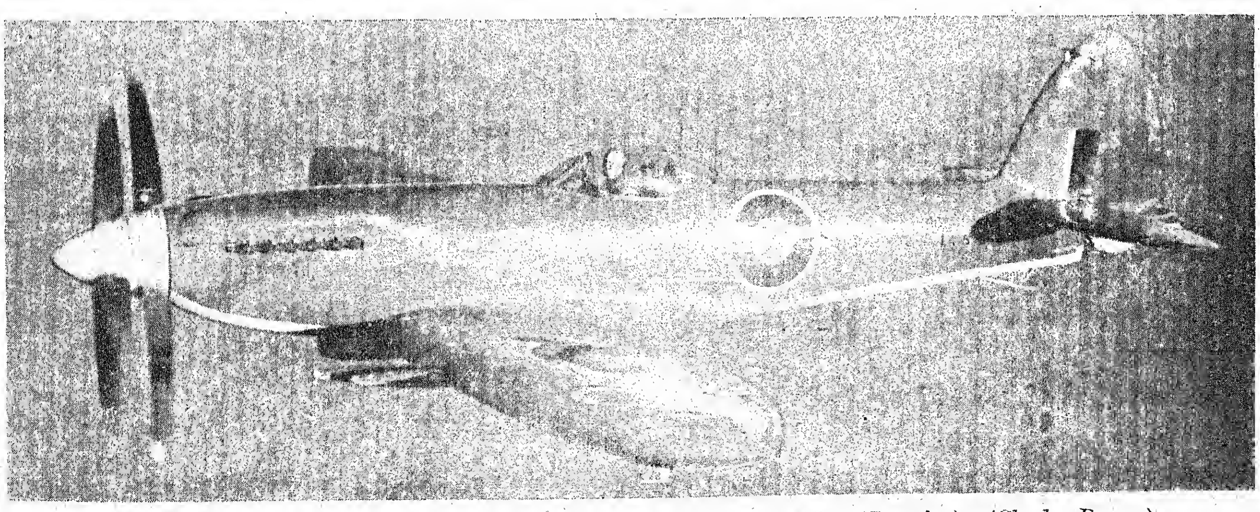
ACCOMMODATION AND ARMAMENT.—As Spitfire 22 but with curved windscreen.

EQUIPMENT.—As Spitfire 22, plus provision for R.A.T.O.G.



The Supermarine Seafire 45 Fleet Fighter.

DIMENSIONS.—Span 36 ft. 11 in. (11.26 m.), Width folded 19 ft. 1 in. (5.82 m.), Length 33 ft. 6½ in. (10.23 m.), Height (over airscrew, tail down) 12 ft. 9 in. (3.88 m.), Height with wings folded 13 ft. 10 in. (4.52 m.).



The Supermarine Seafire 46 Single-seat Fleet Fighter (Rolls-Royce Griffon 87 engine).—(*Charles Brown.*)

***SUPERMARINE**—continued.*

The Supermarine Seafire 47 Single-seat Fleet Fighter (Rolls-Royce Griffon 87 engine).

Weights and Loadings.—Weight empty 7,625 lbs. (3,459 kg.), Weight loaded (normal) 10,200 lbs. (4,627 kg.), Weight loaded with 170 Imp. gallon (773 litre) auxiliary tank, 11,615 lbs. (5,269 kg.), Wing loading (normal) 41.9 lbs./sq. ft. (204.6 kg./sq. m.), Power loading 4.29 lbs./h.p. (1.92 kg./CV).

Performance.—Maximum speed 452 m.p.h. (727 km.h.) at 20,500 ft. (6,253 m.), Speed at 10,700 ft. (3,265 m.) 405 m.p.h. (652 km.h.), Speed at sea level 382 m.p.h. (615 km.h.), Maximum rate of climb 4,800 ft./min. (1,464 m./min.) at sea level, Rate of climb at 22,000 ft. (6,710 m.) 3,360 ft./min. (1,025 m./min.), Service ceiling 43,100 ft. (13,145 m.), Normal range 400 miles (644 km.) at 215-235 m.p.h. (346-378 km.h.) at 20,000 ft. (6,095 m.), Maximum range with extra 135 Imp. gallons (614 litres) fuel, 940 miles (1,512 km.) at 214-234 m.p.h. (344-377 km.h.) at 20,000 ft. (6,095 m.), Take-off run in 30 m.p.h. (48 km.h.) wind 126 yds. (115 m.).

THE SUPERMARINE S.14/44.

A new projected Supermarine three-seat amphibian to replace the Sea Otter has been designed to Specification S.14/44. This aircraft is to be a cantilever high-wing monoplane powered by a Rolls-Royce Griffon twelve-cylinder vee liquid-cooled engine driving two three-blade contra-rotating co-axial tractor airscrews. The wing is equipped with a variable incidence device which allows it to be set at the optimum angle for take off and other conditions of flight. This device was incorporated in the experimental Supermarine Type 322 monoplane (*q.v.*). The entire trailing-edge of the wing is hinged, the outer sections acting as ailerons and the inner sections as slotted flaps. Full-span leading-edge slots are fitted. The outer wing sections are made to fold rearwards for stowage.

The hull is a two-step all-metal structure and terminates in a swept-up stern which carries the dihedral tailplane and toed-in twin fins and rudders mounted as endplates. Wing-tip floats are carried on single cantilever struts. The landing gear consists of two main wheels which retract rearwards into the sides of the hull and are enclosed by fairing plates. A retractable tail-wheel is contained within the water-rudder. The complete main-wheel assembly may be removed to allow the aircraft to operate purely as a flying-boat. A deck arrester hook may be fitted for deck-landing purposes.

Dimensions.—Span 56 ft. 0 in. (15.40 m.), Width folded 23 ft. 0 in. (7.02 m.), Length 44 ft. 0 in. (13.42 m.), Height overall 16 ft. 0 in. (4.88 m.).

Weights and Performance.—No data available.

THE SUPERMARINE SEA OTTER.

The Sea Otter I, which was produced before the war and went into service in 1939, was designed to replace the Walrus on reconnaissance and general naval duties, including Air/Sea Rescue. The version used for the latter duties was known as the ASR Mk. II.

Structurally the Sea Otter is similar to the Walrus, the main external difference being in the installation of a tractor instead of a pusher power plant, and various other refinements have been incorporated.

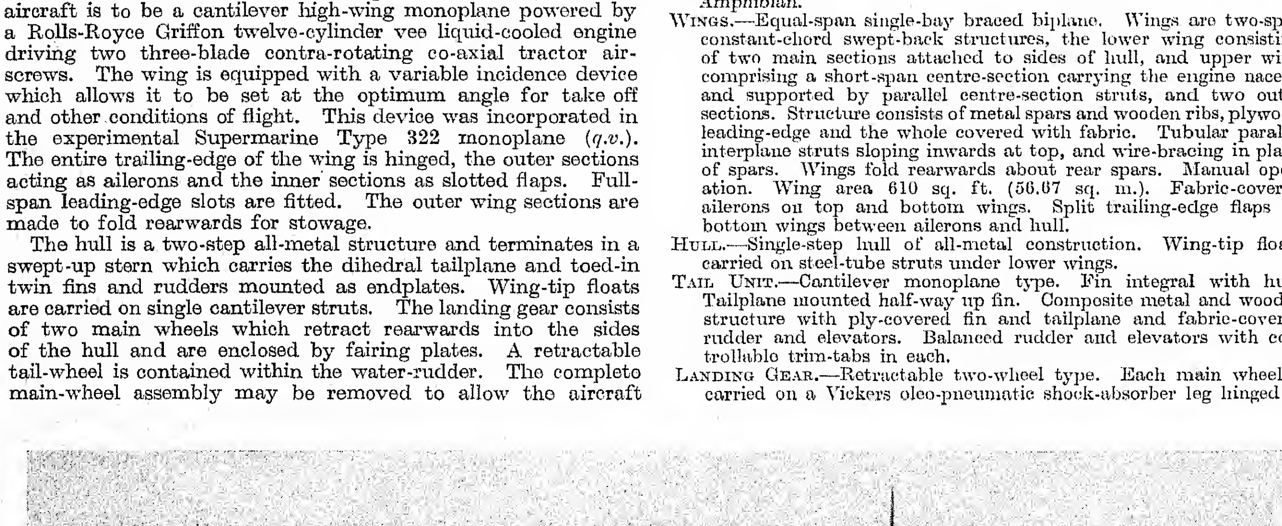
Type.—Single-engined Naval Reconnaissance and Air/Sea Rescue Amphibian.

Wings.—Equal-span single-bay braced biplane. Wings are two-spar constant-chord swept-back structures, the lower wing consisting of two main sections attached to sides of hull, and upper wing comprising a short-span centre-section carrying the engine nacelle and supported by parallel centre-section struts, and two outer sections. Structure consists of metal spars and wooden ribs, plywood leading-edge and the whole covered with fabric. Tubular parallel interplane struts sloping inwards at top, and wire-bracing in plane of spars. Wings fold rearwards about rear spars. Manual operation. Wing area 610 sq. ft. (56.67 sq. m.). Fabric-covered ailerons on top and bottom wings. Split trailing-edge flaps on bottom wings between ailerons and hull.

Hull.—Single-step hull of all-metal construction. Wing-tip floats carried on steel-tube struts under lower wings.

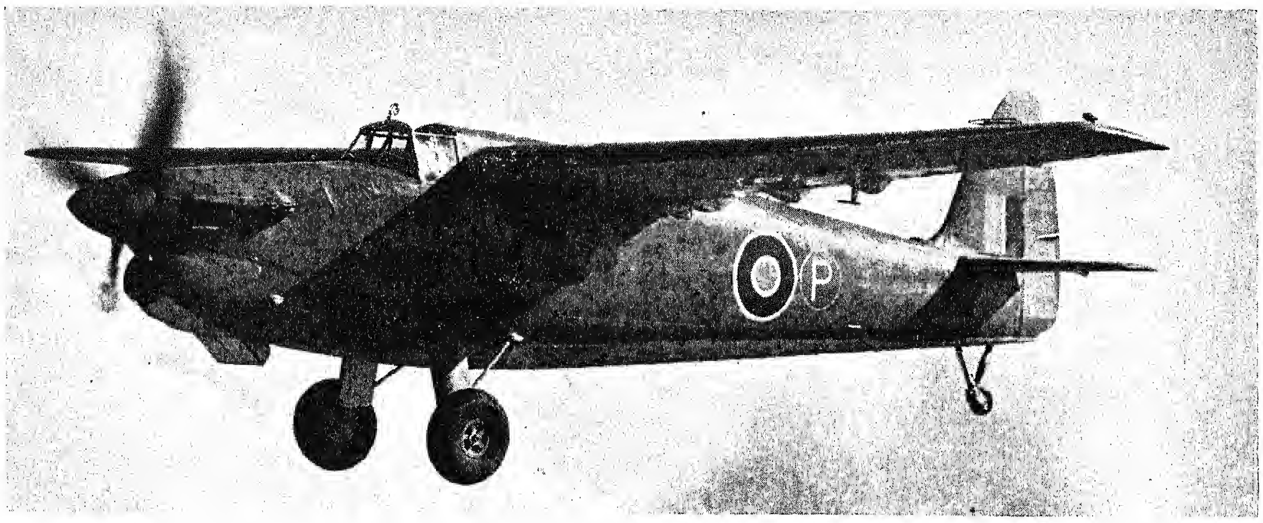
Tail Unit.—Cantilever monoplane type. Fin integral with hull. Tailplane mounted half-way up fin. Composite metal and wooden structure with ply-covered fin and tailplane and fabric-covered rudder and elevators. Balanced rudder and elevators with controllable trim-tabs in each.

Landing Gear.—Retractable two-wheel type. Each main wheel is carried on a Vickers oleo-pneumatic shock-absorber leg hinged to



The Supermarine Sea Otter General Purposes Amphibian Flying-boat with wings folded.

***SUPERMARINE**—continued.*



The Supermarine Type 322 Experimental Monoplane (Rolls-Royce Merlin 30 engine).—(*Charles Brown*).

side of hull, with rear bracing strut, and retracts outwards into lower wing. Hydraulic operation. Track 7 ft. 5 in. (2.26 m.). Complete main-wheel assembly can be removed and aircraft operated purely as flying-boat. Combined tail-wheel and water-rudder at extreme stern under rudder.

POWER PLANT.—One Bristol Mercury 30 nine-cylinder radial air-cooled engine developing a maximum level output of 855 h.p. at 4,500 ft. (1,375 m.); a maximum continuous cruising output of 740 h.p. at 5,000 ft. (1,525 m.), and a take-off output of 805 h.p. Engine mounted on upper wing centre-section and enclosed in cowling with leading-edge collector-ring. Rotol three-blade constant-speed airscrew, 11 ft. 3 in. (3.43 m.) diameter. Fuel capacity 162 Imp. gallons (736 litres) in tanks in upper wing roots. Auxiliary fuel tank may be installed in hull. Oil capacity 11 Imp. gallons (50 litres). Maximum fuel capacity as flying-boat 206 Imp. gallons (936 litres), and oil capacity 14.5 Imp. gallons (66 litres).

ACCOMMODATION.—Crew of three or four. Pilot's enclosed cockpit forward of wings, and open cockpit amidships. Radio and navigation compartment aft of pilot's cockpit. Mooring hatch in bows. Folding berth in A.S.R. version.

ARMAMENT.—Twin .303 in. (7.9 m/m.) Vickers K gas-operated machine-guns on ring mounting over amidships cockpit. Total rounds 1,200. Light bombs or depth charges can be carried in universal carriers under lower wings.

EQUIPMENT.—Full radar, radio and navigational equipment.

DIMENSIONS.—Span 46 ft. 0 in. (14.02 m.), Width folded 18 ft. 0 in. (5.5 m.), Length (tail up) 39 ft. 9 in. (12.12 m.), Height (one airscrew blade vertically downwards, tail up) 16 ft. 2 in. (4.93 m.).

WEIGHTS AND LOADINGS.—Weight empty (amphibian) 6,805 lbs. (3,089 kg.), Weight empty (flying-boat) 6,475 lbs. (2,937 kg.), Removable equipment 580 lbs. (263 kg.), Crew (three) and parachutes 600 lbs. (272 kg.), Fuel and oil 1,265 lbs. (4,198 kg.), Wing loading 15.1 lbs./sq. ft. (73.7 kg./sq. m.), Power loading at take-off 11.4 lbs./h.p. (5.22 kg./CV).

PERFORMANCE.—Maximum speed 150 m.p.h. (241 km.h.) at 5,000 ft. (1,525 m.), Cruising speed 100 m.p.h. (161 km.h.) at 5,000 ft. (1,525 m.), Initial rate of climb 870 ft./min. (265 m./min.), Climb to 5,000 ft. (1,525 m.) 6.20 minutes, Service ceiling 16,000 ft. (4,880 m.), Normal range in still-air 565 miles (909 km.), Maximum range 725 miles (1,167 km.), Take-off distance to 50 ft. (15 m.) from land 555 yds. (507 m.), Take-off time from water 24 seconds.

THE SUPERMARINE CIVIL SEA OTTER.

The Sea Otter military amphibian described above has been made available for civilian duties, and can be operated as a short-range passenger transport or training amphibian. All military gear has been removed and the hull accommodates four passenger seats, three on the starboard side and one on the port. The pilot's compartment is separated from the main cabin by a bulkhead, and the passenger entry is *via* the deck hatch amidships measuring 3 ft. 1¼ in. × 2 ft. 8½ in. (0.94 m. × 0.825 m.). At the rear of the cabin is a toilet compartment. The cabin is sound-proofed by glass wool, and the temperature is controlled by a 15,000 B.T.U. Janitrol heater.

The civil version retains the Bristol Mercury 30 engine of the military aircraft, and there is capacity for 162 Imp. gallons (737 litres) fuel. With the landing gear removed the disposable load is increased from 1,790 lbs. to 2,120 lbs. (812 kg. to 962 kg.).

WEIGHTS AND LOADINGS (As flying-boat).—Weight empty 6,465 lbs. (2,932 kg.), Fuel and oil 1,265 lbs. (574 kg.), Disposable load 2,120 lbs. (962 kg.), Weight loaded 9,850 lbs. (4,468 kg.), Wing loading 16.1 lbs./sq. ft. (78.6 kg./sq. m.), Power loading 11.5 lbs./h.p. (5.2 kg./h.p.).

PERFORMANCE.—Maximum speed 150 m.p.h. (241 km.h.) at 5,000 ft. (1,525 m.), Cruising speed 100 m.p.h. (161 km.h.), Initial rate of climb 808 ft./min. (246 m./min.), Climb to 5,000 ft. (1,525 m.) 6.7 minutes, Service ceiling 13,800 ft. (4,205 m.), Normal range 520 miles (837 km.), Maximum range 700 miles (1,126 km.), Take-off distance to 50 ft. (15 m.) from land 661 yds. (604 m.), Take-off time from water 28.6 seconds.

THE SUPERMARINE TYPE 322.

The Type 322 was an experimental aircraft produced to Specification S.24/37 for a naval torpedo-bomber. It was a cantilever high-wing monoplane which employed a variable-incidence wing to enable it to attain the slow landing speed and steep take-off angle desirous in a deck-landing aircraft. The wing was pivoted on the main spar, and electrically-operated. Full-span Handley Page leading-edge slots were fitted, and the entire trailing-edge was hinged to form ailerons and slotted flaps.

Two Type 322's were built. The first prototype was fitted with a 1,300 h.p. Merlin 30 twelve-cylinder vee liquid-cooled engine and was completed early in 1943. The fuselage employed four spruce longerons and a stressed plywood skin, and the wings were also mostly of wooden construction. The second aircraft was powered by a 1,620 h.p. Merlin 32 engine and had Alclad-covered outer wings and increased fin and rudder area. A fixed two-wheel landing-gear was fitted.

Only two aircraft of this type were built and the Fairey Barracuda, built to the same Specification, was subsequently accepted. The principle of the variable-incidence wing, however, has been incorporated in the new Supermarine S.14/44 amphibian (*q.v.*).

DIMENSIONS.—Span 50 ft. 0 in. (15.24 m.), Length 40 ft. 0 in. (12.19 m.), Height 14 ft. 2 in. (4.32 m.), Wing area 284 sq. ft. (26.38 sq. m.), Aspect ratio 8.8.

WEIGHTS AND LOADINGS.—Weight empty 9,175 lbs. (4,162 kg.), Designed weight loaded 12,000 lbs. (5,443 kg.), Wing loading 42.2 lbs./sq. ft. (19.36 kg./sq. m.).

PERFORMANCE.—Maximum speed 279 m.p.h. (449 km.h.) at 4,000 ft. (1,220 m.), Cruising speed 250 m.p.h. (402 km.h.) at 2,000 ft. (610 m.).

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The Tipsy Aircraft Co., Ltd., was formed in 1937 to build Tipsy aircraft under licence from the Fairey Aviation Co., Ltd., the proprietors of the designs.

The Tipsy Monoplane, now re-named the Belfair, is in production at the Belgian Avions Fairey factory. At the outset the British Belfair will be assembled from parts made in Belgium.

THE TIPSY BELFAIR.

The Belfair is substantially the same as the Tipsy B Monoplane last described in the 1939 Edition of "All the World's Aircraft." It is a two-seat cantilever low-wing monoplane with side-by-side seating and is powered by a 62 h.p. Walter Mikron four-cylinder inverted air-cooled engine driving a two-blade fixed-pitch wooden airscrew.

DIMENSIONS.—Span 31 ft. 2 in. (9.49 m.), Length 21 ft. 8 in. (6.60 m.), Height 5 ft. 8 in. (1.73 m.), Wing area 130 sq. ft. (12.07 sq. m.).

WEIGHTS AND LOADINGS.—Weight empty 540 lbs. (245 kg.), Normal weight loaded 1,100 lbs. (499 kg.), Wing loading 8.5 lbs./sq. ft. (41.5 kg./sq. m.), Power loading 17.8 lbs./h.p. (7.96 kg./h.p.).

PERFORMANCE.—Cruising speed 100 m.p.h. (161 km.h.), Stalling speed 37 m.p.h. (60 km.h.), Rate of climb 500 ft./min. (152 m./min.), Ceiling 20,000 ft. (6,095 m.), Normal range (with 13.2 Imp. gallons =60 litres) 465 miles (748 km.), Take-off run 85 yds. (78 m.), Landing run 65 yds. (59 m.).

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Vickers (Aviation), Ltd. was formed in July, 1928, when Vickers, Ltd. formed their Aviation Department into a separate subsidiary company to take over the manufacture of aircraft, aircraft accessories and equipment. In November, 1928, Vickers (Aviation), Ltd. took over the control of the Supermarine Aviation Works, Ltd.

In October, 1938, Vickers (Aviation), Ltd. and the Supermarine Aviation Works (Vickers), Ltd. were taken over by Vickers-Armstrongs, Ltd.

Vickers aircraft were operated in the 1914-18 War and subsequently have covered a wide range of types in both military and civil spheres. In latter years the Vickers-Wallis geodetic system of construction has been developed. This method is particularly suitable for building streamlined curvilinear bodies.

The material is put in the most advantageous position for developing the maximum stiffness of structure, and also in the most efficient form for resisting large loads and developing high stress. Aircraft built on this principle therefore combine in a marked degree great stiffness and strength with a structure weight so low as to give range and load-carrying figures that had hitherto been considered unattainable.

A further advantage inherent in this system of construction is the absence of bulkheads, frames or ribs. The interior of both wings and fuselage is entirely unobstructed, leaving the full volume available for stowage, passenger quarters, tanks, etc.

The exterior surface can be covered with either fabric, metal plating or plywood. A novel method of attaching fabric to the geodetic bars was developed so that the usual quality of approved linen fabric was capable of withstanding pressures of over 1,000 lbs. per sq. ft. (4,882 kg./sq. m.).

The first aircraft to employ geodetic structure was the Wellesley single-engined general-purpose monoplane, full particulars of which were given in the 1939 edition of "All the World's Aircraft". From this design was developed the twin-engined Wellington, which played an important rôle in the early months of the war, and which was in fact flown operationally in various forms until VJ-Day. Particulars of all the various versions were given in the last issue of this Annual. A variation of the Wellington was the Warwick reconnaissance and transport monoplane. Many Warwicks of various marks are still used for transport duties, and are still employed with Coastal Command. Following the Warwick came the Windsor four-engined heavy bomber, which was produced only in prototype form due to changing operational requirements. All of these types employed geodetic construction.

Vickers were engaged in extensive sub-contract work during the war, and their shadow-factories produced 11,988 Spitfires; 8,946 Wellingtons and 569 Avro Lancasters.

The V.C. 1 Viking twin-engined airliner is the only current aircraft of Vickers design in production. This aircraft is of semi-geodetic construction and uses wings of similar plan form to those of the Wellington. The Viking is being produced in large numbers and has been ordered by many air lines in various parts of the World.

A development of the Viking to comply to the Brabazon IIB Specification is the V.C.2 Viceroy. This aircraft will be similar to the Viking, but will be powered by four Rolls-Royce Dart gas-turbine engines driving tractor airscrews, and will have an enlarged fuselage. A full description of the V.C.1 and brief particulars of the V.C.2 are given hereafter.

Vickers are also experimenting with rocket-propelled radar-controlled explosive missiles. At the time of writing one aircraft of this type was under construction. It will be a small high-wing monoplane with a bullet-shaped fuselage and a wing-span of 6 ft. 8 in. (2.03 m.), and will be launched from a D.H. Mosquito. The maximum speed will be about 800 m.p.h. (1,287 km.h.).

In 1946 particulars of an experimental fighter, the Type 432 designed to Specification F.7/41, were released. A brief description of this aircraft appears on a later page.

THE VICKERS V.C.2 VICEROY.

The V.C.2 is a progressive development of the V.C.1 Viking. It will have a larger fuselage and four Rolls-Royce Dart gas-turbine engines driving tractor airscrews. A tricycle landing-gear will replace the earlier two-wheel type and a dihedral tailplane will be fitted.

Dimensions.—Span 89 ft. 0 in. (27.12 m.), Length 74 ft. 6 in. (22.71 m.). Height 26 ft. 8 in. (8.13 m.). Wing area 885 sq. ft. (82.2 sq. m.).

Weight and Loading (Designed).—Weight loaded 38,500 lbs. (17,463 kg.). Wing loading 42.8 lbs./sq. ft. (209 kg./sq. m.).

Performance (Estimated).—Maximum speed 330 m.p.h. (531 km.h.), Range 1,380 miles (2,227 km.).

THE VICKERS-ARMSTRONGS V.C.1 VIKING.

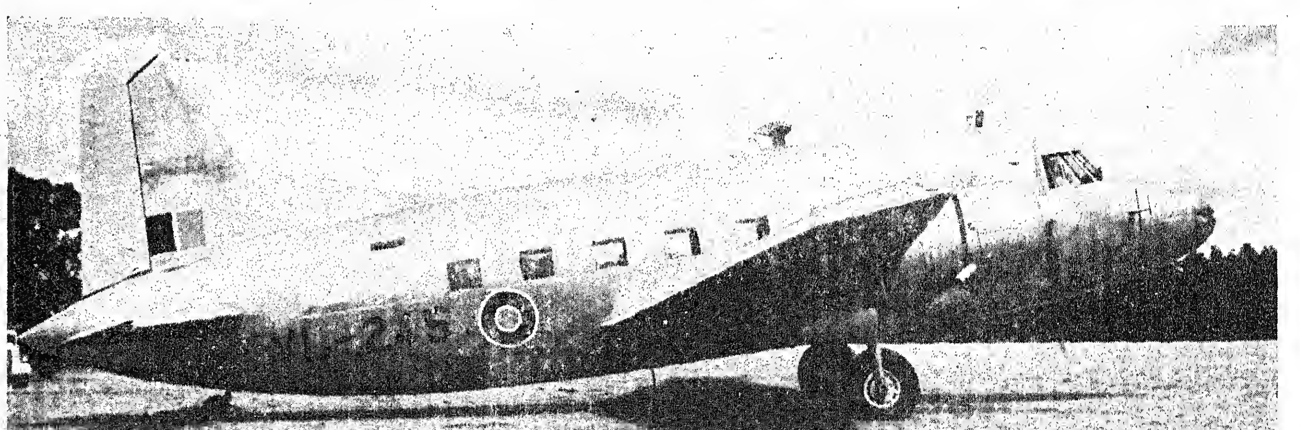
The Viking is a medium-range passenger or freight-carrying aircraft, the first prototype of which flew on June 22, 1945. This aircraft had a stressed-skin fuselage, and fabric covered geodetic wings similar to those of the Wellington bomber. On the second aircraft the wings were metal-plated. The third prototype had composite geodetic and stressed skin wings, and this system has been retained on production models. In 1946 a modified version was produced. This was the Mk. IB which has the forward section of the fuselage increased 2 ft. 4 in. (0.71 m.) in length to provide extra accommodation in the forward cabin

The Viking is available in two standard versions, one to carry twenty-four and the other to carry twenty-seven passengers. Vikings are in service with, or have been ordered by, British European Airways and many foreign transport companies. Four have also been chosen to equip The King's Flight. In addition, others have been delivered to R.A.F. Transport Command for personnel transport.

The following specification applies to the Mk. IB, which supercedes the earlier versions.

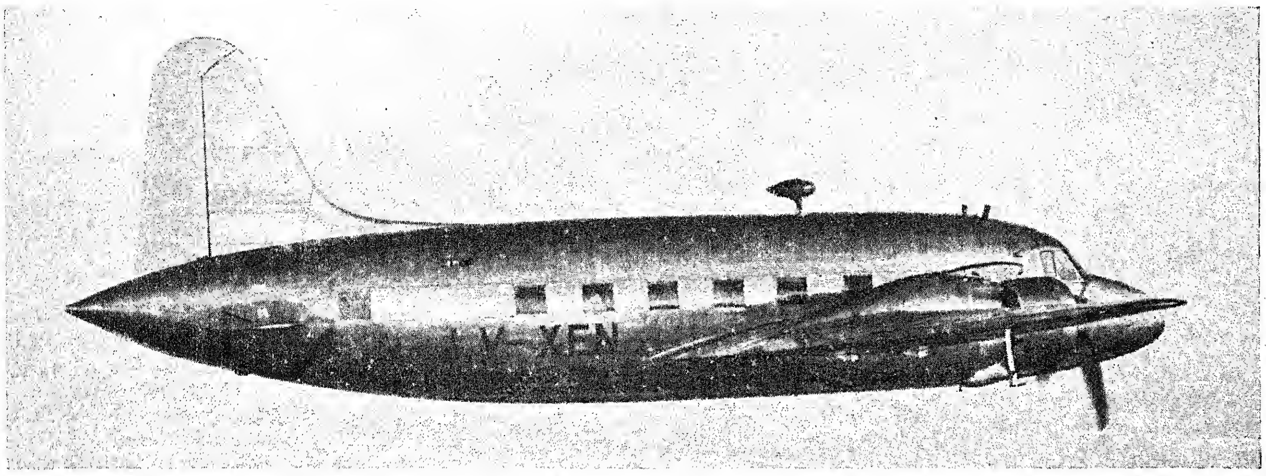
Type.—Twin-engined medium-range Airliner.

Wings.—Cantilever mid-wing monoplane. All-metal structure consisting of two inner and two outer sections. Single spar at 30% chord is free to float vertically in tunnel through fuselage to permit bending deflections. Inner wing sections of geodetic construction consisting of spar with Warren-girder webs and double-tubular boom; top-hat section chordwise stiffeners and bearing strips bolted to geodetic members, and unstressed Alclad skin riveted on. Auxiliary spars ahead of and aft of main spar consist of C-tube top and bottom booms with riveted plate web carrying closely-spaced vertical channel stiffeners. Metal skin leading-edge reinforced by channel formers is bolted to front auxiliary spar. Trailing-edge sections of dural-tube construction, have Warren bracing webs, and are bolted to rear auxiliary spar. Attachment to fuselage at leading and trailing-edges by high-tensile steel link arms retained in Silentbloc rubber/metal bushes in fuselage frames. Outer wing sections consist of I-section spar, seven stiff chordwise ribs inter-spaced with chordwise stiffeners, enclosed by front and rear auxiliary spars forming torsion-box. Stressed Alclad skin. Main



A Vickers-Armstrongs Viking C. Mk. I (two Bristol Hercules engines) of The King's Flight, R.A.F.

***VICKERS-ARMSTRONGS**—continued.*



A Vickers-Armstrongs Viking I Airliner (two Bristol Hercules engines) as supplied to the Argentine Government.

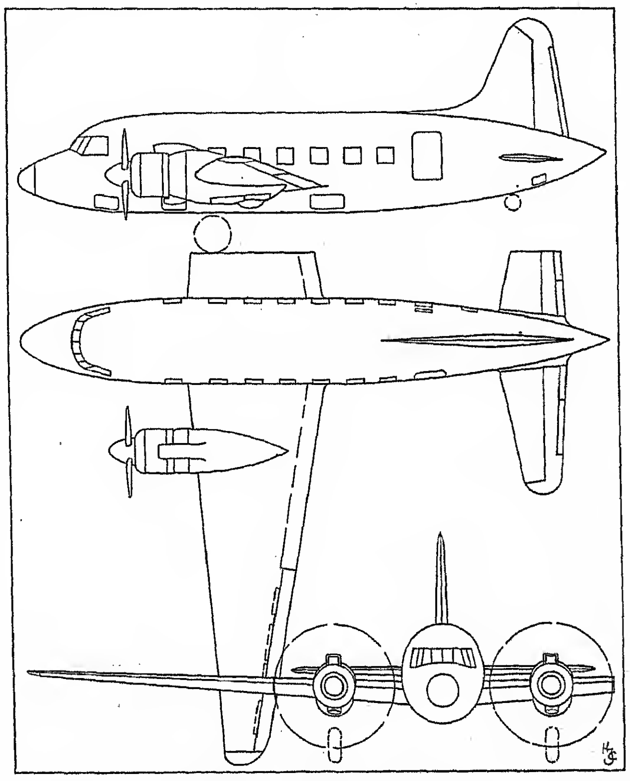
spar has T-section booms machined from solid-tensile dural, riveted plate web and closely-spaced Z-section vertical stiffeners. At approximately two-thirds distance to wing-tip main spar is built-up I-section with angle spanwise plates. Trailing-edge of outer sections built up of angle-section riblets and Warren webs. Separate wing-tips attached by counter-sunk screws and Simmonds nuts. Front and rear auxiliary spars have one-piece booms and flat plate webs. Aspect ratio 9; mean chord 9.88 ft. (3.01 m.); gross wing area 882 sq. ft. (81.93 sq. m.). Fabric-covered Frise-type metal ailerons on outer sections, with adjustable hand trim-tab in port and pre-set tab in starboard. Schrenk split trailing-edge flaps between ailerons and fuselage. Hydraulic operation.

FUSELAGE.—All-metal oval-section monocoque structure, with transverse frames of 18G high-tensile dural, longitudinal stringers attached to frames by shear cleats, and stressed Alclad skin riveted to stringers. Heavy frames of double 12G channel-section to which leading and trailing-edges attached, and at tail-unit pick-up points.

TAIL UNIT.—Cantilever monoplane type. All-metal structure similar to outer wing sections, with I-section main spar in fin and tailplane; Warren-braced ribs interspaced with Z-section chordwise stringers and stressed Alclad skin. Horn-balanced rudder of similar construction with fabric covering. Rudder has single combined spring-tab and hand trim-tab for heavy and light loads respectively. Elevators constructed as rudder, with asymmetrical horn-balanced portions and mass-balances. Differential elevator tabs; controllable tab in port, and balance tab in starboard.

LANDING GEAR.—Retractable two-wheel type. Each main wheel 45 in. × 16 in. (1,143 m/m. × 406 m/m.) carried between twin Vickers oleo-pneumatic shock-absorber legs which retract rearwards into engine nacelle and are enclosed by twin doors in two sections. Hydraulic operation. Tyre pressure 56 lbs./sq. in. (3.94 kg./sq. c/m.). Track 22 ft. 10 in. (6.96 m.), wheel base 33 ft. 5 in. (10.17 m.). Full-castering tail-wheel retracts rearwards into recess in fuselage. Tyre pressure 76 lbs./sq. in. (5.36 kg./sq. c/m.). Pneumatic brakes on main wheels.

POWER PLANT.—Two Bristol Hercules 634 fourteen-cylinder two-row radial air-cooled sleeve-valve engines each rated at 1,690 h.p. for take-off. Engines mounted as interchangeable power-eggs at junction of inner and outer wing sections on steel tube W-frames, and enclosed in long-chord cowlings with leading-edge collector ring and controllable trailing-edge gills. Nacelles of monocoque construction with outer and inner skins connected by lateral plate bulkheads. De Havilland or Rotol four-blade constant-speed full-feathering metal airscrews, 13 ft. 3 in. (4.04 m.) diameter. Total fuel capacity 740 Imp. gallons (3,409 litres) contained in five tanks in each outer wing, three in front of and two aft of main spar. Oil tank of 16 Imp. gallons (73 litres) capacity and reserve fuel tank of 58 Imp. gallons (264 litres) capacity in top of each nacelle. Hobson-R.A.E. fuel injection system.

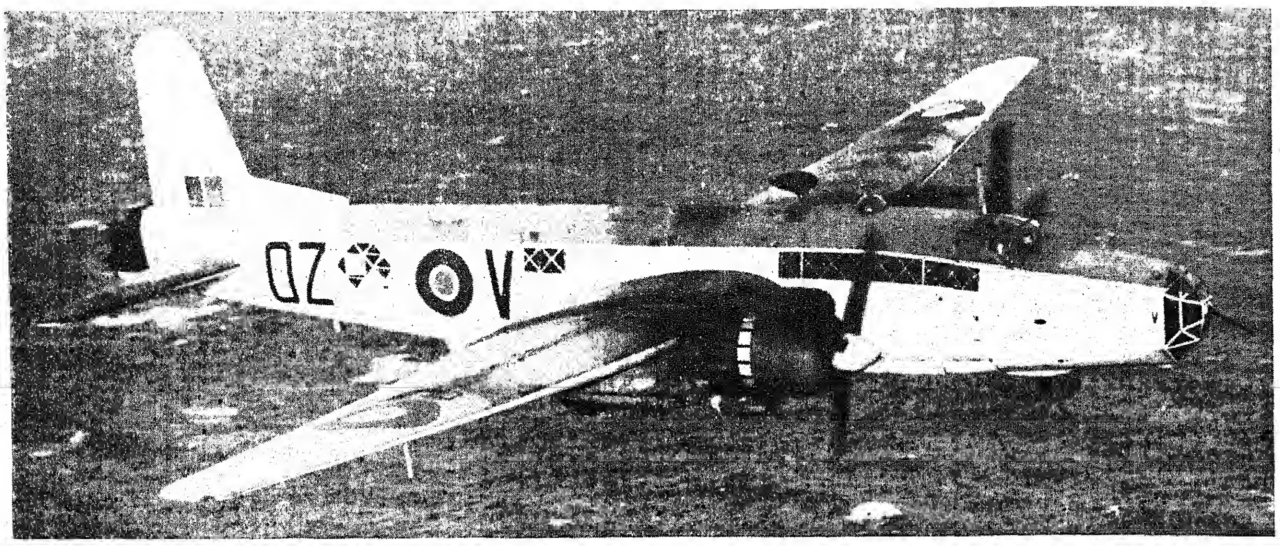


The Vickers Viking I Airliner.

ACCOMMODATION.—Crew compartment forward with seats for pilot and co-pilot/wireless operator side-by-side with dual controls. Radio (on starboard) and navigator's position immediately behind. Volume 305 cub. ft. (8.95 cub. m.). Entrance door 2 ft. 3 in. × 2 ft. 9 in. (0.69 m. × 0.84 m.) under fuselage, and communication door into forward cabin. Passenger accommodation in two cabins.

A Vickers-Armstrongs Viking IB Airliner of Central African Airways.

***VICKERS-ARMSTRONGS**—continued.*



The Vickers-Armstrongs Warwick V General Reconnaissance Monoplane (two 2,500 h.p. Bristol Centaurus VII engines).

Forward cabin 11 ft. 1 in. long × 7 ft. 11 in. wide × 6 ft. 7 in. high (3.38 m. × 2.41 m. × 2.01 m.) has floor area of 78 sq. ft. (7.25 sq. m.) and volume of 520 cub. ft. (14.71 cub. m.). Normal accommodation for nine, with three pairs on starboard side and three single seats on port. Forward seats face rearward. Rear cabin, aft of spar tunnel, is 19 ft. 6 in. long × 7 ft. 11 in. wide × 6 ft. 7 in. high (6.04 m. × 2.41 m. × 2.01 m.), has floor space of 136 sq. ft. (12.62 sq. m.) and volume of 915 cub. ft. (25.9 cub. m.). Seats for fifteen or eighteen passengers arranged as in forward cabin. Main entrance door 5 ft. 2 in. × 3 ft. 0 in. (1.57 m. × 0.91 m.) on port side of fuselage aft of cabins gives access to vestibule (volume 170 cub. ft.=4.81 cub. m.) and thence to rear cabin. Pantry (90 cub. ft.=2.55 cub. m.) with seat for stewardess, and toilet compartment (80 cub. ft.=2.26 cub. m.) on starboard side. Full-length freight hold under floor is 31 ft. 4 in. (9.54 m.) long and has average height of 1 ft. 10 in. (0.56 m.). Volume 270 cub. ft. (7.64 cub. m.). Five loading doors accessible from ground as follows:—Port, (forward) 5 ft. × 2 ft. 8 in. (1.52 m. × 0.81 m.); (aft) 3 ft. 6½ in. × 2 ft. (1.08 m. × 0.61 m.). Starboard, (forward) 3 ft. 7½ in. × 2 ft. 6 in. (1.1 m. × 0.76 m.), (midships) 3 ft. 6½ in. × 2 ft. (1.08 m. × 0.61 m.), (aft) 3 ft. 6½ in. × 2 ft. 7 in. (1.08 m. × 0.79 m.).

EQUIPMENT.—T.K.S. de-icing. Dinghy stowage in rear of nacelles.

DIMENSIONS.—Span 89 ft. 3 in. (27.2 m.), Length (tail up) 65 ft. 2 in. (19.86 m.), Height (tail up) 24 ft. 0 in. (7.32 m.), Height (tail down) 19 ft. 6 in. (5.94 m.).

WEIGHTS AND LOADINGS.—Weight empty (24-seat version—equipped) 22,910 lbs. (10,392 kg.), (27-seat version—equipped) 23,000 lbs. (10,433 kg.), Fuel and payload (24-seat version) 11,090 lbs. (5,030 kg.), Fuel and payload (27-seat version) 11,000 lbs. (4,989 kg.), Maximum take-off weight 34,000 lbs. (15,422 kg.), Maximum landing weight 32,500 lbs. (14,742 kg.), Wing loading (at 34,000 lbs. =15,422 kg.) 38.5 lbs./sq. ft. (188 kg./sq. m.), Power loading at take-off 10.05 lbs./h.p. (4.56 kg./h.p.).

PERFORMANCE.—Cruising speed (at 31,800 lbs.=14,424 kg., Maximum weak mixture=83% METO power) 263 m.p.h. (423 km.h.) at 10,000 ft. (3,050 m.), Recommended cruising speed (775 h.p. per engine=50% METO power) 210 m.p.h. (338 km.h.), Normal rate of climb 500 ft./min. (152 m./min.), Maximum rate of climb (at 34,000 lbs.=15,422 kg.) 1,500 ft./min. (457 m./min.) at 3,000 ft. (915 m.), One-engine rate of climb 275 ft./min. (84 m./min.) at sea level, Still-air range with 500 Imp. gallons (2,273 litres) 1,130 miles (1,818 km.) at 210 m.p.h. (338 km.h.), with 750 Imp. gallons (3,409 litres) 1,700 miles (2,736 km.) at 210 m.p.h. (338 km.h.), Minimum take-off dustance to 50 ft. (15 m.) 850 yds. (777 m.), Take-off distance to 50 ft. (15 m.) allowing for failure of one engine on climb 1,150 yds. (1,051 m.), Landing distance from 50 ft. (15 m.) 1,300 yds. (1,189 m.), Fuel consumption 91 Imp. gallons (414 litres) per hour at 210 m.p.h. (338 km.h.).

THE VICKERS-ARMSTRONGS WARWICK.

The Warwick is a slightly enlarged version of the Wellington twin-engined bomber, a full structural specification of which appeared in the last issue of "All the World's Aircraft". The Warwick employs the same geodetic form of construction, and was designed originally to Specification B.1/35 as a bomber to replace the Wellington, but because the generation of four-engined was also being produced at the same time, it was subsequantly adapted for reconnaissance duties with Coastal Command. Other versions were made suitable for transport and Air/Sea rescue work. Details of the Mks. I, II, III, IV and V were given in the last issue of this Annual.

The latest version, the Mk. V, is powered by two 2,500 h.p. Bristol Centaurus VII eighteen-cylinder sleeve-valve radial air-cooled engines and differs from the earlier models in having a slightly lengthened nose, and later a corresponding dorsal fin. The power-operated nose-turret was removed and a multi-panel nose mounting a single .5 in. (12.7 m/m.) machine-gun is installed. The mid-upper turret was also removed and replaced by two manually-operated .5 in. (12.7 m/m.) machine-guns, one on each side of the fuselage mid-way between the wings and tail-unit. The tail turret with four .303 in. (7.9 m/m.) machine-guns is retained.

A blister beneath the nose carries radar equipment, and a retractable Leigh Light is situated under the fuselage.

An experimental Warwick III is equipped with two 2,310 h.p. Napier Sabre VI twenty-four-cylinder sleeve-valve H-type liquid-cooled engines with annular radiators and driving De Havilland four-blade constant-speed airscrews, 15 ft. (4.57 m.) diameter. This version has a loaded weight of 44,573 lbs. (20,218 kg.) and a speed of over 345 m.p.h. (555 km.h.).

The G.R. Mk. V is a reconnaissance version and can carry bombs, mines or depth-charges. The following figures apply to this version, which is still in service with Coastal Command.

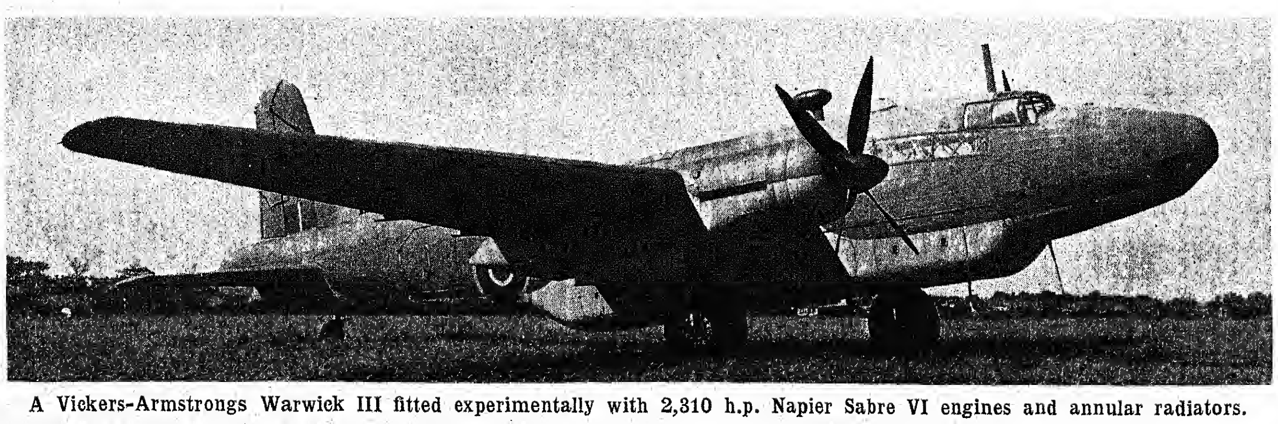
DIMENSIONS.—Span 96 ft. 8½ in. (29.5 m.), Length 75 ft. 6 in. (23 m.), Height 18 ft. 6 in. (5.64 m.), Gross wing area 1,006 sq. ft. (93.45 sq. m.).

WEIGHTS AND LOADINGS.—Maximun weight loaded 45,000 lbs. (20,410 kg.), Wing loading (maximum) 44.7 lbs./sq. ft. (218 kg./sq. m.), Power loading 9 lbs./h.p. (4.08 kg./h.p.).

PERFORMANCE.—Maximum speed (approximate) 290 m.p.h. (467 km.h.).

THE VICKERS-ARMSTRONGS TYPE 432.

The Type 432 was an experimental twin-engined single-seat fighter fitted with a pressure-cabin, and was intended to combat any stratosphere raids that may have been made against this country. It was designed originally to meet the requirements of Specification F.22/39, but was later modified to conform to Specification F.16/40 and ultimately to Specification F.7/41.



A Vickers-Armstrongs Warwick III fitted experimentally with 2,310 h.p. Napier Sabre VI engines and annular radiators.

VICKERS-ARMSTRONGS—continued.

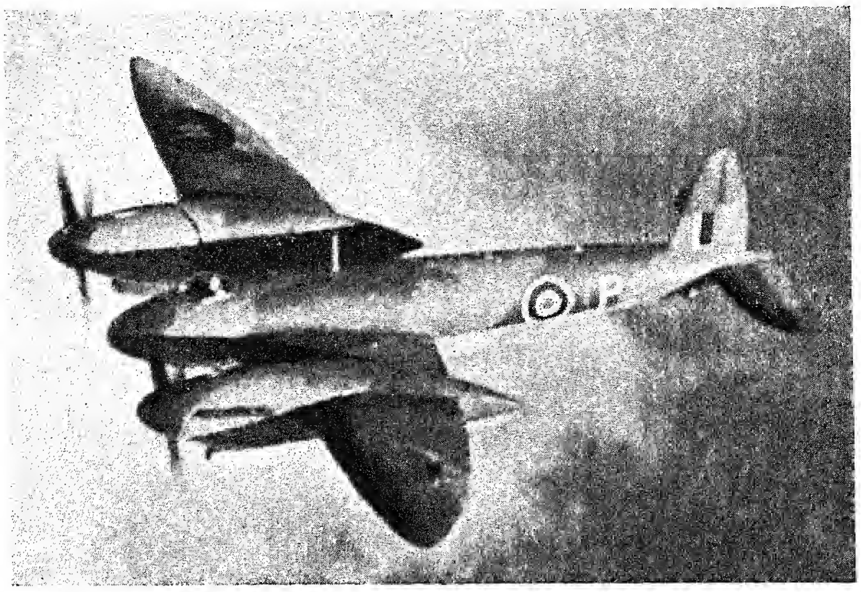
The prototype made its first flight in December, 1942, but the type was not produced in quantity because the expected stratosphere raids did not materialise.

The F.7/41 was an all-metal mid-wing monoplane with elliptical wings, the outer sections of which were slightly swept forward, and a single fin and rudder. The landing-gear was a retractable two-wheel type. The power plant consisted of two 1,280 h.p. Rolls-Royce Merlin 61 twelve-cylinder vee liquid-cooled engines driving four-blade airscrews. Armament consisted of six 20 m/m. cannon contained in an oval-shaped blister under the centre fuselage.

Dimensions.—Span 56 ft. 10½ in. (17.33 m.), Length 40 ft. 7½ in. (12.38 m.), Height 13 ft. 9 in. (4.19 m.), Wing area 441 sq. ft. (40.96 sq. m.), Aspect ratio 7.13.

Weights and Loadings.—Weight empty 16,373 lbs. (7,427 kg.), Weight loaded 20,168 lbs. (9,148 kg.), Wing loading 45.9 lbs./sq. ft. (224 kg./sq. m.), Power loading 7.8 lbs./h.p. (3.53 kg./h.p.).

Performance.—Maximum speed 408 m.p.h. (657 km.h.) at 26,000 ft. (7,925 m.), Cruising speed 245 m.p.h. (394 km.h.), Service ceiling 37,000 ft. (11,275 m.), Cruising range 1,870 miles (3,010 km.).



The Experimental Vickers-Armstrongs 432 Pressurized Single-seat Fighter (two 1,280 h.p. Rolls-Royce Merlin 61 engines).

WESTLAND.

WESTLAND AIRCRAFT, LTD.

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Directors: The Rt. Hon. Lord Aberconway, C.B.E. (Chairman), Eric Mensforth, C.B.E., M.A., M.I.Mech.E., M.I.P.E. (Vice-Chairman), John Fearn, M.I.Mech.E. (Managing Director), Arthur Davenport, F.R.Ae.S. (Technical Director), Edward C. Wheeldon, M.I.P.E. (Deputy Managing Director), Sir George E. Bailey, C.B.E., Air Vice-Marshal Sir Norman D. K. MacEwen, C.B., C.M.G., D.S.O., Sir Holberry Mensforth, K.C.B., C.B.E., Sir Felix J. C. Pole and S. W. Rawson.

Chief Designer: F. J. W. Digby.

Secretary: W. B. Hickman, A.C.A.

Westland Aircraft Ltd. was formed in July, 1935, to take over the aircraft branch of Petters Ltd., previously known as the Westland Aircraft Works, which had been engaged in aircraft design and construction since 1915.

In July, 1938, Petters' works were acquired and at the same time John Brown & Co. Ltd., the well-known shipbuilding firm, purchased the greater part of Petters' holding in Westland Aircraft, Ltd., the remainder being acquired at a later date by Associated Electrical Industries, Ltd.

During the war and up to the end of 1945, Westland Aircraft, Ltd. built 1,426 Lysanders, 114 Whirlwinds plus two prototypes and 61 Welkins, plus detail components for a further 100. It also manufactured 685 Spitfire IB, VB and VC and 1,279 Seafire IIC, III, XV and XVII under sub-contract. The Westland company was included in the original Barracuda group production scheme but owing to its commitments in the Spitfire and Seafire production programme it withdrew from the Barracuda scheme after building 18.

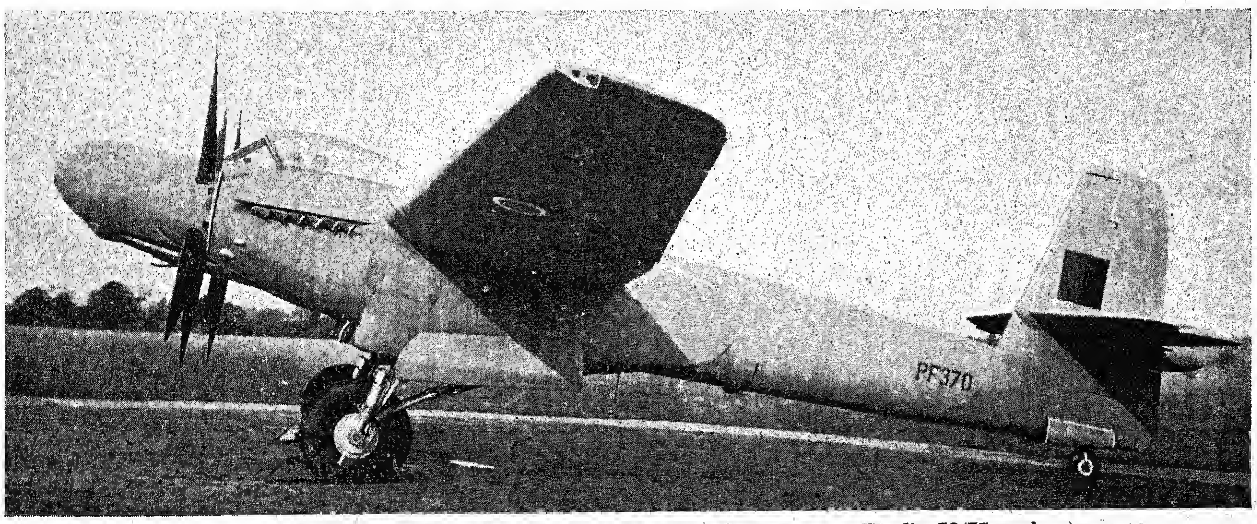
The Westland company also undertook extensive research and development with atmosphere control equipment, particularly in connection with the Welkin high-altitude fighter. Westland automatic control valves have also been used in every British pressure-cabin military aircraft. To exploit this development in the wider post-war field a subsidiary company, Normalair, Ltd. has been formed. Atmosphere control equipment is now being designed and manufactured for a number of British pressurised civil aircraft.

Westland Aircraft, Ltd. has acquired the licence to build the S-51 helicopter from the Sikorsky Division of the United Aircraft Corpn. The Westland S-51 helicopter will be powered with the Alvis Leonides engine.

THE WESTLAND WELKIN.

The Welkin I single-seat high-altitude fighter was designed to Specification F.4/40. So that full use could be made of the Welkin's ability to fight at great heights, a basic part of the design was a cabin which could be automatically pressurised. This consisted of a relatively small self-contained unit made of extremely heavy gauge bullet-resisting light alloy and bolted to the front face of the main spar, with an armoured steel bulkhead at the rear and a special openable bulkhead at the nose.

Concurrently with the development of this cabin, extensive research was necessary to produce a coupé top with a wide field of vision, which not only had to take the abnormal loads of pressurisation but also had to be both slidable for ingress and jettisonable. A sandwich system of glazing was finally evolved, in which the thick inner shell retained the pressure and an outer shell acted as a fairing, leaving a space between through which warm air could be circulated to prevent icing and misting.



The Westland Welkin II Two-seat High Altitude Fighter (Rolls-Royce Merlin 76/77 engines).

***WESTLAND**—continued.*

An Experimental Version of the Westland Welkin I fitted with Rolls-Royce Merlin RM16SM engines and beard-type radiators.

The half-cylindrical canopy terminates in a thick laminated glass pressure-retaining bulkhead and abuts on a fixed windscreen similarly composed of a sandwich system of glazing. The de-misting air is drawn through a rain-trap entry and after passing through a glycol heater is led to the space between the inner and outer shells. A Dunlop rubber gasket fitted round the periphery of the hood and automatically inflated when the cabin pressure is on provided the solution to the problem of securing a seal between the sliding and fixed parts of the coupé.

To avoid the necessity for the pilot to concentrate on his cabin pressure an ingenious cabin atmosphere control valve was developed which automatically gave the appropriate pressure for any given height, using a differential of 3.5 lbs./sq. in. (0.24 kg./sq. c/m.) and employing air supplied to the cabin inlet by a Rotol cabin blower, the valve controlling the exit of air to the atmosphere.

To reduce as far as possible the necessity for a number of pressure glands to give egress from the cabin to numerous small controls, an electrical system using grouped and pressure-tight junction boxes was adopted and a special remote-control unit devised to operate all trim-tabs and fuel cocks.

The first prototype Welkin flew on November 1, 1942, and production began early in 1943. As enemy high-flying raiders never appeared over England in numbers the Welkin I did not go into operational service.

One version of the Welkin I was fitted with Merlin RM16SM (developed into Merlin 113-114) engines which employed beard-type radiators of increased cooling area. This aircraft, which was first flown in June, 1945, had a maximum speed of 398 m.p.h. (640 km.) at 30,000 ft. (9,145 m.).

Two examples of a two-seat version known as the Welkin II were built but this model did not go into production. Basically the Mk. II was similar to the earlier Mark, but had a longer cabin in which the pilot was moved forward and an observer's seat facing aft was added. The front windscreen was redesigned to give a lower sill line and the nose of the fuselage was increased in length to accommodate AI radar equipment. The outer wing sections were given an increased dihedral angle of 4½ degrees. The Mk. II was powered by Rolls-Royce Merlin 76/77 engines.

Type.—Single-seat High-altitude Fighter.

Wings.—Cantilever mid-wing monoplane. Aerofoil section (root) NACA 23021; (tip) NACA 23015. All-metal stressed-skin structure consisting of wide-span centre-section and two outer sections. Detachable tips. Single main spar passes through fuselage, with secondary spar in centre-section carrying flaps. Mean aerodynamic chord 6 ft. 6.96 in. (2 m.); incidence (to fuselage datum line) 3 degrees; dihedral (outer sections, top surface) 3 degrees; aspect ratio 10.65. Gross wing area 460 sq. ft. (42.7 sq. m.). Metal Westland-Irving ailerons on outer sections. Aileron area (total) 54.8 sq. ft. (5.09 sq. m.); aileron movement 16 degrees up; 18 degrees down. Spring-tab in each aileron. Fowler-type trailing-edge flaps on centre-section. Flap area (total) 48 sq. ft. (5.46 sq. m.); depression 48 degrees.

Fuselage.—Oval section structure in two parts, the forward section comprising the cabin of duralumin and the rear section of magnesium. The cabin section is stressed for pressurisation and is bullet-resisting. It is bolted to the front face of the main wing spar and terminates with a steel armoured bulkhead. The rear fuselage is a monocoque, the skin being longitudinally planked.

Tail Unit.—Cantilever monoplane type. The tailplane is mounted about one-third up the fin to ensure good anti-spin qualities at high altitudes. The rudder is in two portions separated by the torpedo-shaped fillet forming the intersection of the tailplane and fin. Electrically-operated trim-tabs in elevators and rudder. Tailplane area 61.8 sq. ft. (5.74 sq. m.), Rudder area (total) 23.39 sq. ft. (2.17 sq. m.), Fin area 28.25 sq. ft. (2.62 sq. m.), Elevator area (total) 37.48 sq. ft. (3.48 sq. m.).

Landing Gear.—Retractable type. Main wheels raised backwards into engine nacelles, tail-wheel into fuselage. Lockheed shock-absorbers. Dowty hydraulic retraction. Dunlop wheels and brakes. Track 17 ft. 6 in. (5.33 m.).

Power Plant.—Two Rolls-Royce Merlin engines with two-speed two-stage superchargers, Mk. 72 or 76 in the starboard nacelle and 73 or 77 in the port nacelle, the port engine driving the Rotol cabin supercharger. Each engine rated at 1,210 h.p. at 2,350 r.p.m. at 26,000 ft. (7,925 m.) with 12 lb./sq. in. (0.84 kg./sq. c/m.) boost, 1,240 h.p. at 3,000 r.p.m. at sea level with 12 lb./sq. in. (0.84 kg./sq. c/m.) boost, and 1,475 h.p. at 3,000 r.p.m. at 23,200 ft. (7,620 m.) with 18 lb./sq. in. (1.26 kg./sq. c/m.) boost. D.H. four-blade constant-speed full-feathering airscrews 12 ft. 6 in. (3.81 m.) diameter. Coolant and oil radiators in centre-section between fuselage and nacelles, the air being led to them by a ducted leading-edge entry with a variable exit at the trailing-edge controlled by the angular setting of the main landing flaps. Integral and armoured fuel tanks in centre-section outboard of the nacelles. Normal fuel capacity 430 Imp. gallons (1,954 litres), Maximum capacity 510 Imp. gallons (2,318 litres). Oil capacity 32 Imp. gallons (145 litres).

Accommodation.—Pilot's cockpit in line with the leading-edge of the wing. Cockpit is pressurised, a Westland control valve automatically regulating the cabin pressure. Automatic cabin-heating control maintains equable temperature at all heights, thereby eliminating the need for special clothing. At low altitudes either heated or cold air can be admitted at will. The pressure-resisting cockpit canopy and bullet-proof windscreen are double skinned with a space for warm air to be circulated by pump to prevent icing and misting.

Armament.—Four 20 m/m. British Hispano cannon in the fuselage nose.

Diensions.—Span 70 ft. (21.35 m.), Length (Mk. I) 41 ft. 7 in. (12.67 m.), Length (Mk. II) 44 ft. 1 in. (13.42 m.), Height 15 ft. 9 in. (4.8 m.), Wing area 460 sq. ft. (42.7 sq. m.).

Weights and Loadings.—Weight empty (with fixed equipment) 14,343 lbs. (6,509 kg.), removable equipment, including cannon and ammunition, 1,077 lbs. (488 kg.), Pilot and parachute 200 lbs. (90 kg.), Fuel and oil 1,980 lbs. (898 kg.), Weight loaded 17,600 lbs. (7,985 kg.), Wing loading 38.2 lbs./sq. ft. (146.5 kg./sq. m.), Power loading 7 lbs./h.p. (3.17 kg./h.p.).

Weights and Loadings (Mk. II.)—Weight empty (with fixed equipment) 15,635 lbs. (7,092 kg.), Removable equipment, including cannon and ammunition 1,900 lbs. (862 kg.), Crew (2) and parachutes 400 lbs. (181 kg.), Fuel and oil 3,957 lbs. (1,795 kg.), Weight loaded 21,892 lbs. (9,930 kg.), Wing loading 47.7 lbs./sq. ft. (233 kg./sq. m.), Power loading 8.7 lbs./h.p. (3.9 kg./h.p.).

Performance.—Maximum speed 387 m.p.h. (623 km.h.) at 26,000 ft. (7,925 m.), Speed at 40,000 ft. (12,190 m.) 358 m.p.h. (576 km.h.), Speed at 30,000 ft. (9,145 m.) 382 m.p.h. (615 km.h.), Speed at 20,000 ft. (6,095 m.) 366 m.p.h. (589 km.h.), Speed at 10,000 ft. (3,050 m.) 352 m.p.h. (566 km.h.), Stalling speed 83 m.p.h. (133 km.h.), Maximum combat rate of climb 3,850 ft./min. (1,173 m./min.), Climb to 10,000 ft. (3,050 m.) at combat rating 2.6 minutes, Climb to 40,000 ft. (12,190 m.), at combat rating 18 minutes, Service ceiling 44,000 ft. (13,410 m.), Operational ceiling 41,000 ft. (12,495 m.), Maximum range 1,200 miles (483 km.) at 35,000 ft. (10,670 m.), Duration (normal) 3 hrs. with ¼ hr. at maximum speed at 35,000 ft. (10,670 m.), Take-off distance to 50 ft. (15 m.) 600 yds. (549 m.), Landing distance from 50 ft. (15 m.) 680 yds. (622 m.).

Performance (Welkin II).—Maximum speed 360 m.p.h. (579 km.h.) at 30,000 ft. (9,145 m.), Speed at 10,000 ft. (3,050 m.) 335 m.p.h. (541 km.h.), Speed at 20,000 ft. (6,095 m.) 346 m.p.h. (557 km.h.), Speed at 35,000 ft. (10,670 m.) 350 m.p.h. (563 km.h.), Speed at 40,000 ft. (12,190 m.) 330 m.p.h. (531 km.h.), Stalling speed 93 m.p.h. (149 km.h.), Maximum combat rate of climb 2,650 ft./min. (810 m./min.) at 10,000 ft. (3,050 m.), Climb to 10,000 ft. (3,050 m.) at combat rating 3.7 minutes, Climb to 35,000 ft. (10,670 m.) at combat rating 20 minutes, Service ceiling (with 50% fuel) 41,000 ft. (12,500 m.), Operational ceiling 37,700 ft. (11,490 m.), Duration 4¼ hrs. plus ¼ hr. at maximum speed at 35,000 ft. (10,670 m.), Take-off distance to 50 ft. (15 m.) 1,020 m., Landing distance from 50 ft. (15 m.) 750 yds. (680 m.).

AUSTRALIA

The biggest and most important plan for the production of aircraft in Australia was that which was originally drawn up for the manufacture of the Bristol Beaufort by the Beaufort Division of the Departmant of Aircraft Production.

This production scheme was designed to secure the greatest degree of decentralisation, whereby parts were manufactured by over four hundred specialised sub-contractors and delivered to the railway workshops in the three States, there to be made up into complete sub-assemblies for delivery to two final assembly plants at Fishermen's Bend, Melbourne, Victoria, and Mascot, Sydney, N.S.W.

In sub-assembly, the works of the New South Wales Government Railways were responsible for the front fuselage, stern frame, landing gear and nacelle structure; the Victorian Railway workshops for the rear fuselage, tail-plane, fin and control surfaces; and the South Australian Government Railway workshops for the centre-section and complete wings. All these sub-assemblies were complete with all equipment and fittings when delivered to the final assembly plants.

It was originally intended that the Bristol Aeroplane Co. Ltd. should supply all drawings, jigs, tools and fixtures, as well as ten sets of fabricated parts and ten sets of raw materials to educate the Australian engineers and operatives in the manufacture of the Beaufort. Conditions brought about by the War interfered with this programme and it became necessary for the Australian engineers to undertake some of the preliminary work and a large number of jigs and tools had to be manufactured locally. For the same reason Australia was thrown back on its own resources for the development of constant-speed airscrews, oleo landing-gear struts, self-sealing petrol tanks, gun-turrets, instruments, as well as aircraft steels, duralumin and Alclad sheet and various other items.

Another big problem arose when it was found that the Bristol Taurus engine for which the Beaufort was designed would not be obtainable in any quantity for the Australian Beaufort owing to home demands and transport difficulties. The Australian Beaufort had therefore to be modified to take the Pratt & Whitney Twin-Wasp engine and a licence for the manufacture of this engine was obtained by the Commonwealth Aircraft Corporation, which was already in production with the Wasp engine.

The first Australian Beaufort, largely assembled from British-made parts but fitted with two Twin-Wasp engines, flew on May 5, 1941. Production reached a "mass" basis in January, 1942, and by the time that the Beaufort was withdrawn from production in 1943 to give place to the Beaufighter, over 700 had been built.

Because of the relationship of the Beaufighter to the Beaufort the change-over was quickly made, the actual production procedure for the two types being identical. The entire airframe and all components of the Beaufighter were manufactured in Australia, only the Bristol Hercules engines being imported from Great Britian. Over 250 Beaufighters were built during the war.

Production of the Avro Lancaster was also undertaken by the Beaufort Division, but this has now been superseded by the Lincoln, which has been adopted as the standard heavy bomber by the R.A.A.F. The Beaufort Division has orders for the manufacture of 61 Lincolns for the R.A.A.F.

The first Australian Lincoln flew on March 17, 1946, twenty-three months after receiving the first drawings from England. The first five aircraft were assembled partially from parts inported from England but thereafter practically the entire aircraft, including engines, is being manufactured in Australia. The first few aircraft were fitted with Packard-built Merlin 85 engines but these have now given place to Merlin 102 engines built in Australia by the Aero-engine Division of the Commonwealth Aircraft Corporation.

In addition, the Beaufort Division is building twelve Avro Tudor II transports for the R.A.A.F. Production of the Tudor II was authorised in July, 1945, and the first aircraft of this type was expected to fly in 1947.

All work in the current Lincoln/Tudor programme is now centred at the Division's Fisherman's Bend plant, near Melbourne.

COMMONWEALTH.

COMMONWEALTH AIRCRAFT CORPORATION PTY., LTD.

Head Office and Works: Fisherman's Bend, Port Melbourne, Victoria.

Aero-Engine Works: Fishermen's Bend, Port Melbourne, Victoria, and Lidcombe, N.S.W.

Manager: Wing-Cdr. L. J. Wackett, D.F.C., A.F.C., B.Sc.

The Commonwealth Aircraft Corporation, Pty., Ltd., was formed in 1936 under a scheme propounded by the Australian Government for the establishment of an aircraft industry to make Australia independent of outside supplies.

The Commonwealth Aircraft Corpn. is financed by some of the most wealthy industrial firms in Australia, and has an authorised capital of £1,000,000. The shareholders include the Broken Hill Pty. Co., the largest iron and steel concern in Australia; Broken Hill Associated Smelters Pty. and its associate, the Electrolytic Zinc Co. of Australia, the largest producers of lead and zinc in the British Empire; Imperial Chemical Industries of Australia and New Zealand, said to be the largest individual industrial concern in the Empire; the Orient Steam Navigation Co.; and General Motors-Holdens, which is allied to General Motors of the U.S.A.

During 1936, an Air Board Technical Commission visited the United States and began negotiations to acquire the licence for the N.A.33 two-seat General Purposes Monoplane from North American Aviation, Inc.

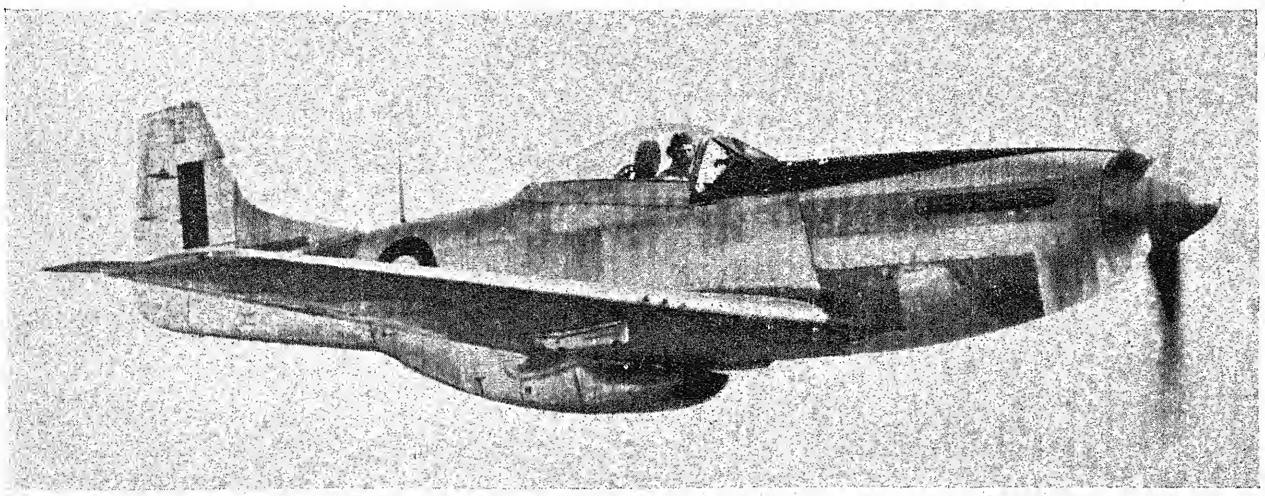
Negotiations for the manufacturing rights were completed in 1937 and the Corporation took delivery of an American-built N.A. 33 for submission to official test by the Royal Australian Air Force. The Australian development was known as the Wirraway and the prototype flew on March 27, 1939. The first of this type was delivered to the R.A.A.F. in July, 1939. Over 700 Wirraways were built.

The Corporation has also produced a two-seat trainer, designed by Wing Commander L. J. Wackett, and fitted with a Warner Super Scarab engine, a twin-engine bomber reconnaissance monoplane fitted with two Pratt & Whitney Twin Wasp engines, a single-seat fighter monoplane known as the Boomerang, approximately 250 of which were built, and a high speed single-seat fighter designated C.A.15.

The Corporation is now in production with the North American Mustang single-seat fighter monoplane. Tooling up for the Mustang began in February, 1944, and the first complete aircraft was ready for test in May, 1945. 250 are to be built, the first 80 from imported parts.

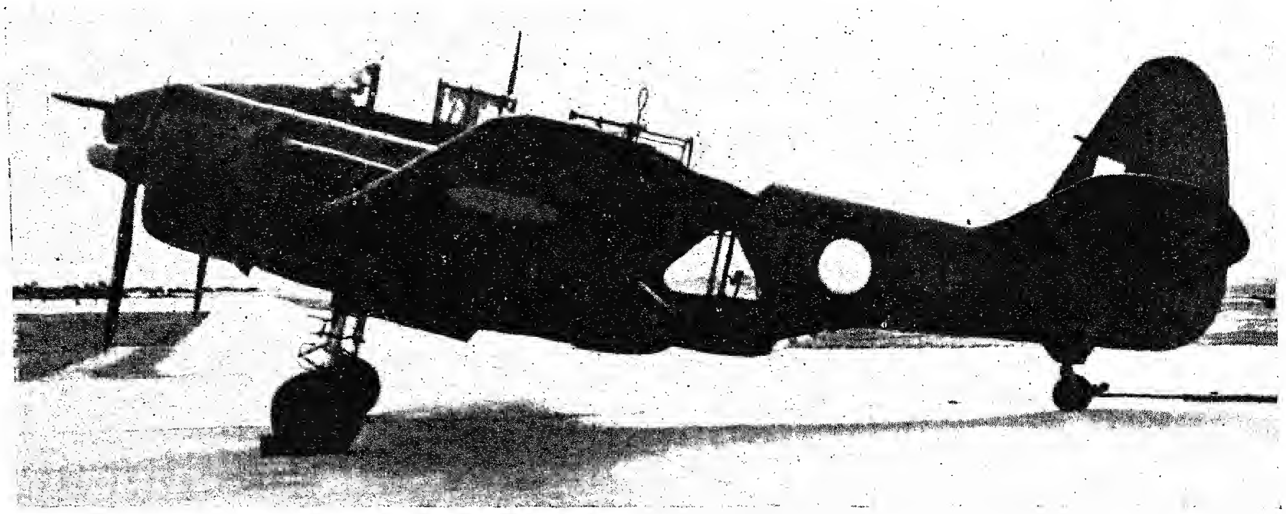
The Commonwealth Aircraft Corpn. also holds the licence to build Pratt & Whitney Wasp and Twin-Wasp engines, and at present the Aero-Engine Works at Lidcombe, N.S.W., which is operated by the Company on behalf of the Commonwealth Government, is producing the Rolls-Royce Merlin 102 twelve-cylinder vee and the Rolls-Royce Nene turbo-jet engines. The first Commonwealth-built Merlin engine was delivered in July, 1946.

The Wasp engine which is used in Wirraway aircraft was produced at the Fishermen's Bend Factory, Victoria, and all manufacturing activities in connection with the Twin-Wasp



A Commonwealth-built North American Mustang Single-seat Fighter (Packard-built Rolls-Royce Merlin V-1650 engine)

***COMMONWEALTH**—continued.*



The Commonwealth C.A.17 Woomera Bomber-Reconnaissance Monoplane (two Australian-built 1,200 h.p. Pratt & Whitney Twin-Wasp engines).

engine which were previously carried out at Lidcombe, have now been transferred to the Fishermen's Bend Plant.

THE COMMONWEALTH C.A.17 WOOMERA.

The Woomera is a twin-engined Bomber-Reconnaissance monoplane which was designed as a possible successor to the Beaufort. It is fitted with two 1,200 h.p. Australian-built Pratt & Whitney Twin-Wasp engines and has a retractable two-wheel landing-gear. The tail-unit is a monoplane structure with a dihedral tailplane. A photograph of the prototype is published herewith, but no further details of this aircraft are available for publication.

THE COMMONWEALTH C.A.15.

The C.A. 15, the prototype of which first flew in March, 1946, is a single-seat long-range fighter of entirely Australian design which was conceived as a possible successor to the Mustang. Although it follows the Mustang formula in general outline the C.A. 15 is larger, heavier, more powerful and embodies a number of new design features. It was originally designed to take the Pratt & Whitney R-2800 fourteen-cylinder radial air-cooled engine, but owing to the difficulty of obtaining this power plant the airframe was re-designed for the Rolls-Royce Griffon 61.

Type.—Single-seat Fighter.

Wings.—Cantilever low-wing monoplane. Low-drag laminar-flow aerofoil section derived from NACA 66 series. Maximum thickness at 45% chord. All-metal structure in two main sections joined on fuselage centre-line. Formed sheet metal spars and ribs, and flush-riveted metal skin. All-metal ailerons over 48% span have shrouded nose balance with fabric seals. Servo and electrically operated trim-tabs. Hydraulically-operated trailing-edge flaps between ailerons and fuselage. Take-off angle 20 degrees; landing, 50 degrees. Wing area 253 sq. ft. (23.49 sq. m.).

Fuselage.—All-metal semi-monocoque structure with flush-riveted stressed metal skin.

Tail Unit.—Cantilever monoplane type. All-metal structure, with flush-riveted metal skin over all surfaces. Tailplane set at 9 degrees dihedral. Trim-tabs in rudder and elevators.

Landing Gear.—Retractable two-wheel type. Wheels retract inwards under fuselage and are enclosed by fairing-plates attached to legs and by hinged flap under fuselage. Dowty Live-Line hydraulic system. Hydraulic brakes on main wheels. Tail wheel retracts into fuselage and is enclosed by twin doors.

Power Plant.—One Rolls-Royce Griffon 61 twelve-cylinder vee liquid-cooled engine rated at 2,035 h.p. with maximum boost of 18 lbs./sq. in. (1.26 kg./sq. c/m.) flexibly mounted on built-up sheet-metal bearers. Rotol four-blade constant-speed airscrew, 12 ft. 6 in. (3.81 m.) diameter with compressed wood blades. Morris-type ducted coolant radiator and intercooler beneath fuselage. Liquid-cooled heat-exchanger for oil system. Cartridge starter. Normal fuel capacity of 220 Imp. gallons (1,000 litres) in wing-tanks and one 30 Imp. gallon (136 litre) tank in fuselage. Two long-range drop-tanks each of 100 Imp. gallons (455 litres) capacity may be carried on bomb-racks under wings.

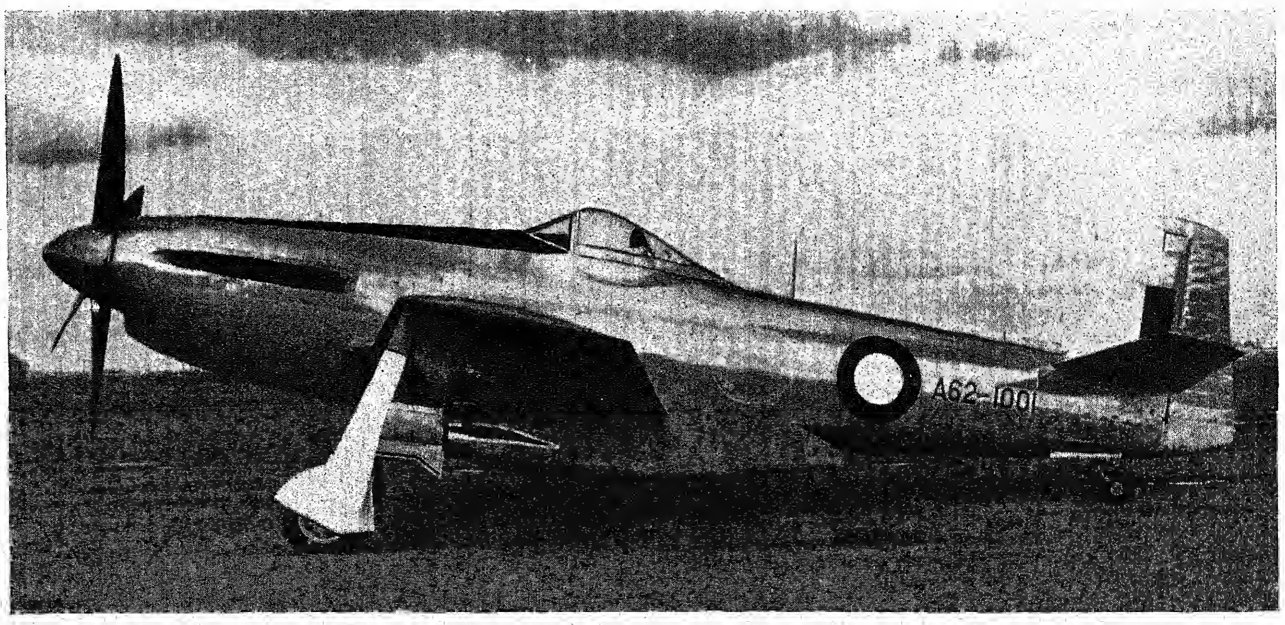
Accommodation.—Pilot's cockpit in-line with leading-edge of wing. Three-panel bullet-proof windscreen and free-blown bubble-type sliding canopy. Canopy, head rest and rear armour can be jettisoned in emergency.

Armament.—Six .5 in. (12.7 m/m.) machine-guns mounted three in each wing with 280 r.p.g. Provision for rocket projectiles and two 500 lb. (227 kg.) or 1,000 lb. (454 kg.) bombs on external racks.

Dimensions.—Span 36 ft. (11 m.), Length 36 ft. 2½ in. (11.01 m.), Height 14 ft. 2¾ in. (4.31 m.).

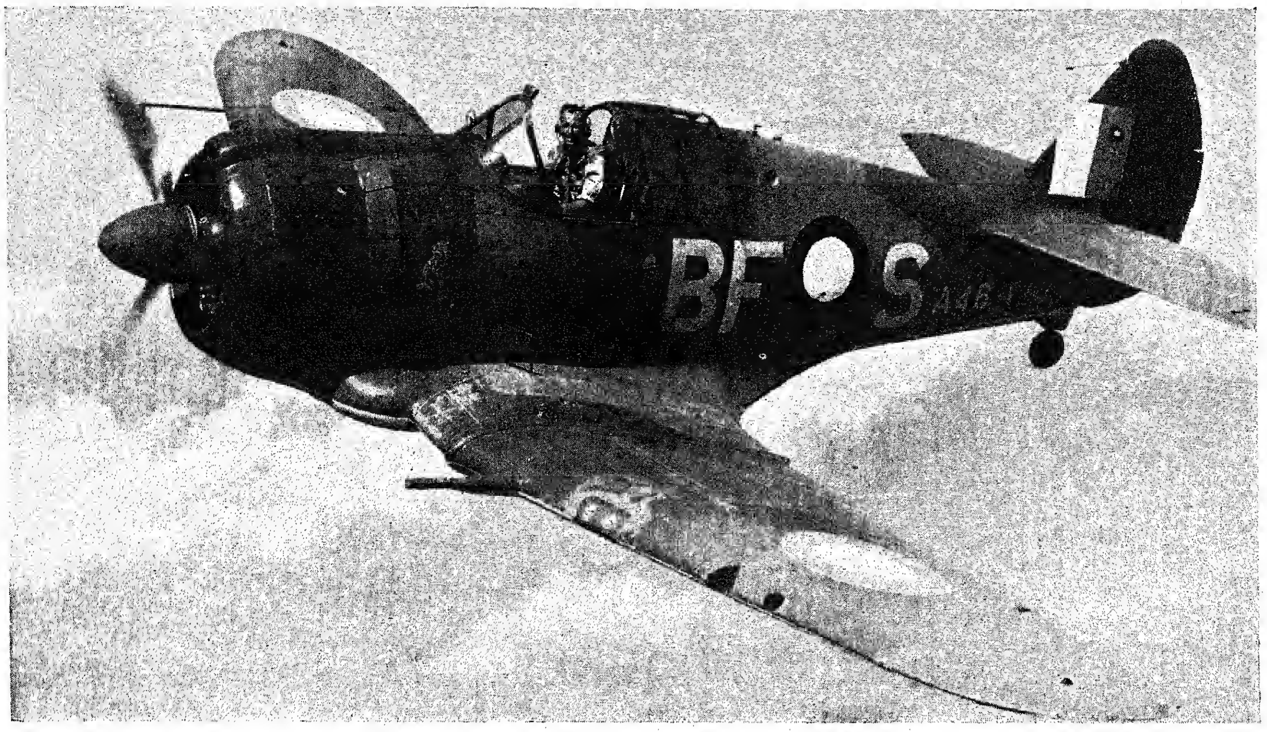
Weights and Loadings.—Weight empty 7,540 lbs. (3,420 kg.), Normal combat weight loaded 9,500 lbs. (4,309 kg.), Maximum permissible loaded weight 12,340 lbs. (5,597 kg.), Wing loading (normal) 37.5 lbs./sq. ft. (183 kg./sq. m.), Wing loading (maximum) 48.8 lbs./sq. ft. (238 kg./sq. m.), Power loading (normal) 4.12 lbs./h.p. (1.85 kg./h.p.).

Performance.—Maximum speed 442 m.p.h. (711 km.h.) at 25,600 ft. (7,800 m.), Speed at sea level 368 m.p.h. (592 km.h.), Climb to 20,000 ft. (6,095 m.) 5.5 minutes, Service ceiling 34,000 ft. (10,365 m.), Maximum range 2,540 miles (4,097 km.) at 5,000 ft. (1,525 m.) at 1,600 r.p.m.



The Commonwealth C.A.15 Single-seat Fighter (2,035 h.p. Rolls-Royce Griffon 61 engines).

***COMMONWEALTH**—continued.*



The Commonwealth Boomerang Single-seat Fighter (1,200 h.p. Australian-built Pratt & Whitney R-1830-S3C4-G Twin-Wasp engine).

THE COMMONWEALTH BOOMERANG.

The Boomerang is a single-seat fighter monoplane, the design of which incorporates the principal distinctive features of the Wirraway. These include the rectangular centre-section and tapering outer sections, with all taper on the leading-edge; continuous flaps between the ailerons; inwardly retractable landing-gear with the wheel pockets forward of the main spar and protruding ahead of the leading-edge; and the Wirraway tail-unit.

The pilot's cockpit is over the centre of the wing and is provided with a sliding canopy, bullet-proof windscreen and armour protection. Armament includes two 20 m/m. cannon and four .303 in. (7.9 m/m.) machine-guns mounted in the outer wings.

The Boomerang is fitted with an Australian-built 1,200 h.p. Pratt & Whitney R-1830-S3C4-G Twin-Wasp two-row radial air-cooled engine.

DIMENSIONS.—Span 36 ft. 0 in. (11 m.), Length 25 ft. 6 in. (7.77 m.).

WEIGHTS.—Weight empty 5,450 lbs. (2,474 kg.), Normal loaded weight 7,000 lbs. (3,178 kg.), Maximum overloaded weight 7,600 lbs. (3,450 kg.).

PERFORMANCE.—Maximum speed 305 m.p.h. (490 km.h.) at 15,500 ft. (4,700 m.), Range 1,600 miles (2,570 km.) at 175 m.p.h. (281 km.h.) at 10,000 ft. (3,050 m.), Endurance 8.25 hours.

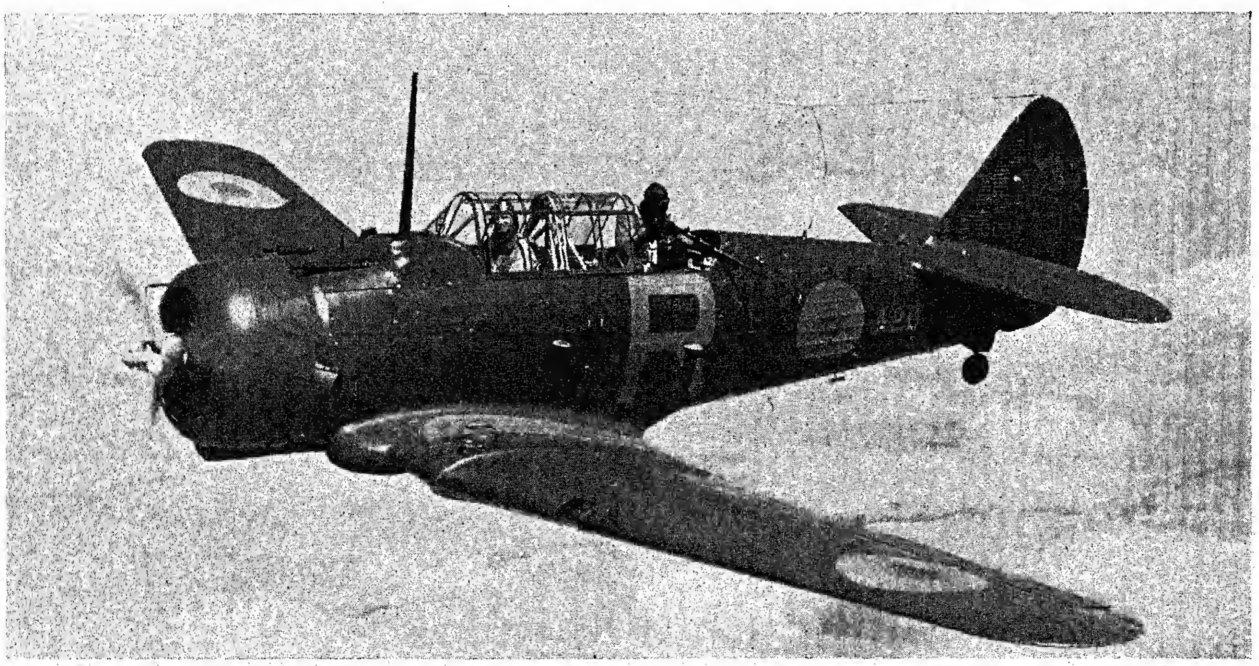
THE COMMONWEALTH WIRRAWAY.

TYPE.—Two-seat General-Purposes military monoplane.

WINGS.—Low-wing cantilever monoplane. Aerofoil section varies from NACA 2215 to 2209. In five sections consisting of centre-section two outer sections and two detachable wing-tips. Centre-section of parallel chord and thickness. Outer sections have swept-back leading-edge and straight trailing-edge and taper in thickness. Single-spar structure with spaced ribs and stressed-skin covering. Dynamically-balanced ailerons with fabric covering. Split trailing-edge flap between ailerons and under fuselage. Wing area 255.75 sq. ft. (23.75 sq. m.).

FUSELAGE.—Welded chrome-molybdenum steel-tube framework with integrally welded fittings. In four sections all bolted together. Sides covered with fabric over aluminium-alloy frames. Decking and under-side are metal covered.

TAIL UNIT.—Cantilever monoplane type. Fixed surfaces metal-covered and movable surfaces fabric-covered. Right and left side of tail-plane and elevators interchangeable. Non-reversible trimming-tabs in elevators and rudder.



The Commonwealth Wirraway Two-seat General Purposes Military Monoplane (600 h.p. Australian-built Pratt & Whitney R-1340-S1SH1S-G Wasp engine).

COMMONWEALTH—*continued.*

Power Plant.—One Australian-built Pratt & Whitney S1H1-G Wasp nine-cylinder radial air-cooled engine rated at 600 h.p. at 7,000 ft. (2,135 m.). D.H. three-blade controllable-pitch airscrew. NACA cowling.

Accommodation.—Tandem cockpits beneath sliding enclosures. Dual controls. Rotating and folding rear seat. Prone bombing position in floor. Special fittings to accommodate full range of equipment for various duties.

Dimensions.—Span 43 ft. (13.11 m.), Length 29 ft. (8.84 m.).

Weights.—Weight empty 3,980 lbs. (1,807 kg.), Weight loaded 6,353 lbs. (2,884 kg.).

Performance.—No data available.

DE HAVILLAND.

DE HAVILLAND AIRCRAFT PROPRIETARY, LTD.

Head Office: Alexandria, N.S.W.

Aircraft Assembly Plant: Bankstown, N.S.W.

Airscrew Factories: Alexandria, N.S.W.

Sales & Service: Kingsford Smith Aerodrome, Mascot, N.S.W.

General Manager: A. Murray Jones, A.F.C.

De Havilland Aircraft Pty. Ltd. was formed in Australia in 1927 to act as agents for the de Havilland Aircraft Co. Ltd., to build de Havilland aircraft under licence, to assemble new aircraft and to operate service stations for de Havilland products throughout Australia.

In 1938-39 the Company began the production of Tiger Moths for the Royal Australian Air Force for use in the Empire Air Training Scheme. At the completion of the contract in 1942, 1,100 aircraft had been delivered, several hundred of which were exported to India, Malaya, Southern Rhodesia and the Netherlands East Indies.

In October, 1941, an order was placed with the Company for the manufacture of 87 D.H. 84 Dragon aircraft to a modified design for use in the Empire Air Training Scheme for the training of wireless operators, navigators and observers. Delivery began in October, 1942, and was completed in June, 1943.

In March, 1942, the Company was requested to design and manufacture an experimental troop-carrying glider to an R.A.A.F. specification. The prototype was designed, and the structure tested, built and flown by June, 1942. After modification to the design, a further six gliders were constructed. Although very successful, they were not used in service owing to the increasing availability of American transport aircraft.

Production of the Mosquito was initiated early in 1942. Drawing, data and technical assistance were made available by the parent Company, Packard Merlin engines were imported from the U.S.A. and certain supplies were obtained from England, Canada and the U.S.A. In order to make full use of available capacity, and for dispersal purposes, a large proportion of the work was sub-contracted throughout several States. The first Australian-built Mosquito was flown on July 23, 1943, a little over a year after receipt of the initial batches of drawings. Production was in full swing at the end of the war and will continue until 1947. The last fifty aircraft will be delivered as T. Mk. 43 dual-control Trainers and P.R. Mk. 41 Photographic Reconnaissance aircraft—the latter being fitted with Merlin 69 two-stage engines.

The D.H. Vampire jet-propelled fighter has been chosen as a standard service type by the R.A.A.F. and will be built in Australia, the airframe by the de Havilland company and the power-unit by the Commonwealth engine factory at Lidcombe, N.S.W.

Prior to the outbreak of War, the Company began construction of a factory for the manufacture of metal controllable-pitch airscrews. First deliveries were made in June, 1940. In 1940, the Government sponsored the enlargement of this factory, and in 1942, the construction of a further factory to cope with the increasing demand for airscrews. First delivery of Hydromatic airscrews was made early in 1944, and, at the cessation of hostilities airscrews had been manufactured for all types of aircraft in production in Australia, as well as other types of airscrews to special orders. In addition, large spares and servicing programmes were maintained. At the present time, airscrews are being manufactured for the Mosquito, Mustang and Lincoln programmes.

THE DE HAVILLAND 5/42 GLIDER.

The de Havilland seven-seat military glider was built to conform to Royal Australian Air Force Specification 5/42 for a troop-carrying glider for use in case of an invasion of Australia. A small number of experimental aircraft were built, but circumstances subsequently did not necessitate the type to be further produced.

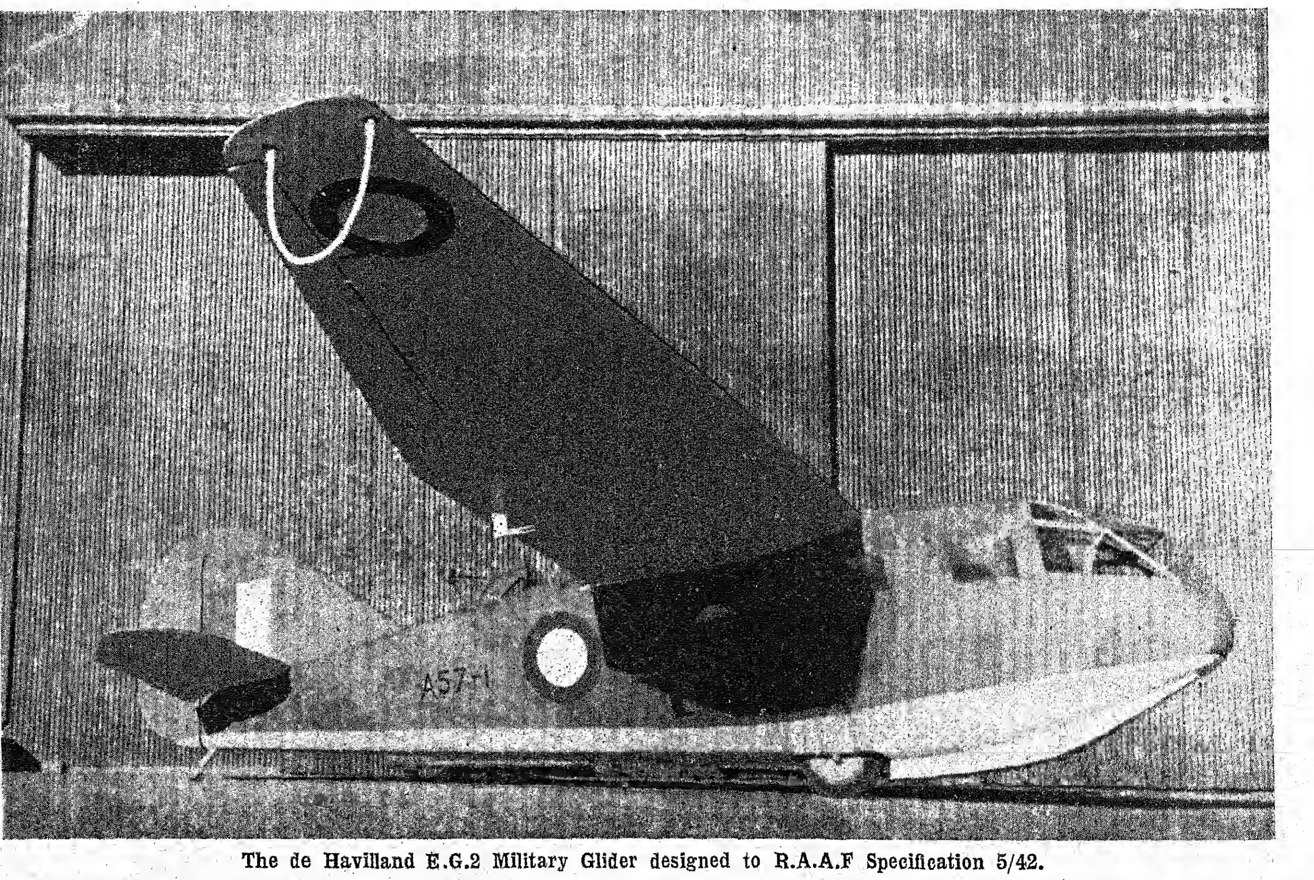
The 5/42 was a simple wooden structure, the nose-section of the fuselage being similar to that of the D.H. 84 Dragon biplane. The first prototype (or E.G.1—Experimental Glider 1) had a one-piece straight-tapered wing with a span of 60 ft. 0 in. (18.29 m.). On the second aircraft, the E.G.2, the one-piece wing was replaced by a single box-spar wing with a constant-chord centre-section and two tapering outer sections. The landing gear consisted of a single main wheel projecting from the fuselage, with a long skid in front and a U-shaped skid at each wing tip.

The following figures apply to the E.G.2.

Dimensions.—Span 50 ft. 6 in. (15.39 m.), Length 33 ft. 0 in. (10.05 m.), Fuselage width 5 ft. 0 in. (1.52 m.), Fuselage height 7 ft. 0 in. (2.13 m.), Wing area 332 sq. ft. (30.89 sq. m.).

Weights and Loadings.—Weight empty 1,450 lbs. (658 kg.), Weight loaded 3,250 lbs. (1,474 kg.). Wing loading 9.7 lbs./sq. ft. (47.35 kg./sq. m.).

Performance (I.A.S.).—Maximum speed 200 m.p.h. (322 km.h.), Towing speed 130 m.p.h. (209 km.h.), Stalling speed 48 m.p.h. (77 km.h.).



The de Havilland E.G.2 Military Glider designed to R.A.A.F Specification 5/42.

CANADA

AVRO.

A. V. ROE (CANADA), LTD.

HEAD OFFICE AND WORKS: MALTON, NEAR TORONTO, ONT.
Chairman: J. P. Bickell.
President: Sir Roy Dobson, K.B.E.
Vice-President and General Manager: Walter N. Deisher.
Assistant to Vice-President: B. S. Shenstone.

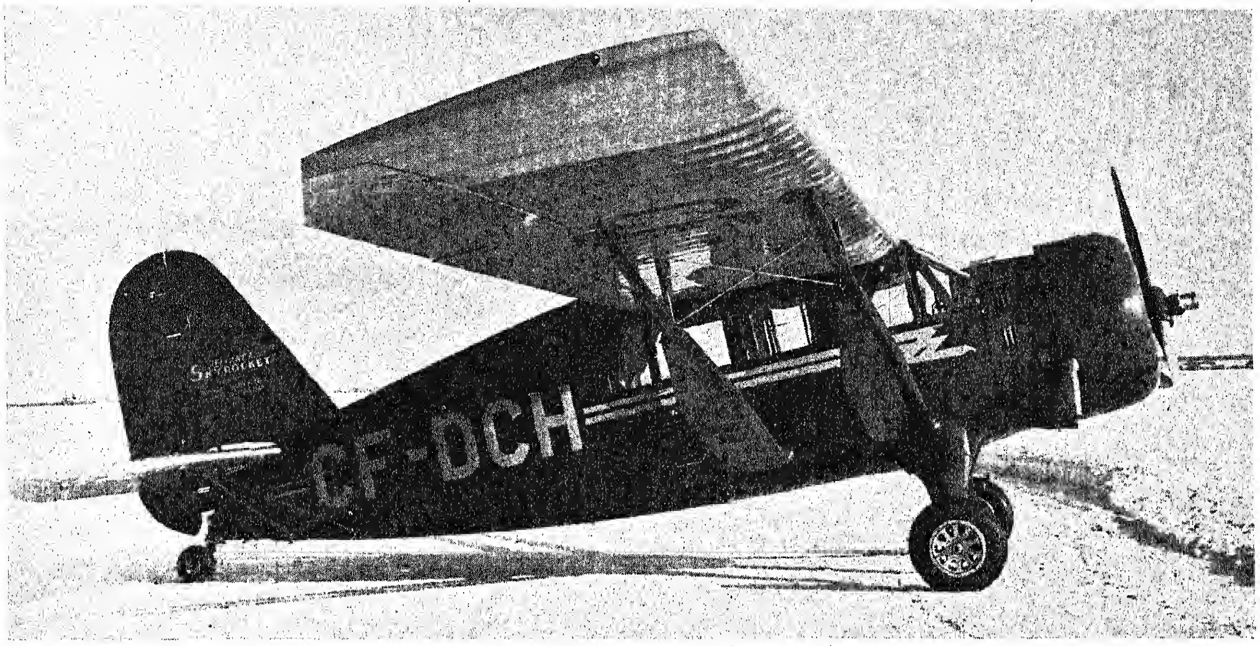
In 1945, A. V. Roe & Co., Ltd. of Manchester, England, acquired from the Canadian Government the Crown-owned plant formerly operated by Victory Aircraft, Ltd., which between 1942 and 1945 was responsible for the production of the Avro Lancaster X bomber. Victory Aircraft also built seven special civil versions of the Lancaster (in reality, the prototypes of the Avro Lancastrian) for the Canadian Government trans-Atlantic air service operated by Trans-Canada Air Lines. Six Avro Lincolns were also completed by Victory Aircraft in 1945, and they were subsequently converted to freighters for the R.C.A.F.

A. V. Roe (Canada) Ltd. has also taken over the Government-owned Turbo-Research, Ltd., which was formed in August, 1944, and the activities of which are being concentrated at the Malton plant.

The company will continue the development of the turbo-jet engine initiated by Turbo-Research, Ltd. and will also design and build the aircraft in which it will be installed. It is also engaged in the development of a training aircraft to a Canadian Government specification for the R.C.A.F.

All profits earned by A. V. Roe (Canada), Ltd. will be shared with the Canadian Government on a fifty-fifty basis.

BELLANCA.



The Bellanca 31-55A Skyrocket single-engined Monoplane (500 h.p. Pratt & Whitney Wasp engine) built under licence by Northwest Industries, Ltd.

NORTHWEST INDUSTRIES, LTD.

HEAD OFFICE AND WORKS: MUNICIPAL AIRPORT, P.O. Box 517, EDMONTON, ALBERTA.
President: W. Leigh Brintnell.
Secretary and Treasurer: John Hunter.

Mr. Leigh Brintwell has been engaged in commercial flying in Northern Canada since 1923. During the last war the entire resources of his company, under the name of Aircraft Repair, Ltd., fulfilled a large contract with the Government to handle the overhaul of all aircraft in the Empire Air Training Scheme for the Province of Alberta and the Western half of Saskatchewan. The company also undertook in 1940 the assembly of aircraft shipped from England for the R.C.A.F. The Government-built factory used in these operations was the most complete of its kind in Canada and during peak production employed 2,600 people.

On the termination of Government contracts the complete plant and all equipment of Aircraft Repair, Ltd., was taken over by Northwest Industries, Ltd., which company has acquired the licence to build the Bellanca Skyrocket and Aircruiser in Canada. It also holds the agency for the 1946 Bellanca Cruisair light four-seat cabin monoplane. Production of the Skyrocket was begun in 1946.

THE BELLANCA MODEL 31-55A SKYROCKET.

TYPE.—Single-engined Cabin monoplane suitable for passenger and freight-carrying, aerial photography, ambulance, etc.

WINGS.—High wing rigidly-braced monoplane. Structure consists of two routed spruce spars, spruce and plywood ribs and fabric covering. Braced by two pairs of parallel steel-tube struts, parts of which are faired to an aerofoil section with metal ribs and fabric covering. Aluminium-alloy split flaps between ailerons and fuselage. Wing area 359 sq. ft. (33.3 sq. m.).

FUSELAGE.—Rectangular framework of welded chrome-molybdenum steel tubing covered with fabric over a secondary structure of spruce and plywood.

TAIL UNIT.—Wire-braced monoplane type. Tailplane structure similar to wings. Fin, rudder and elevators have welded steel-tube frames and fabric covering.

LANDING GEAR.—Two-wheel fixed type interchangeable with Edo floats or Northwest Industries ski-wheel gear. Bendix air-oil shock-absorber struts. Smooth-contour 27 in. (68.5 cm.) Goodyear main wheels. Goodyear disc brakes. 500 × 4 smooth-contour Goodyear full-swivelling tail wheel.

POWER PLANT.—One Pratt & Whitney Wasp S3H1 nine-cylinder radial air-cooled engine rated at 500 h.p. at 2,200 r.p.m. at 5,000 ft. (1,525 m.) and driving a Hamilton Standard two-blade constant-speed airscrew. Fuel tanks in wings. Automatic engine fire-extinguisher.

ACCOMMODATION.—Enclosed cabin with accommodation for crew of two and six passengers. Quickly-removable "bush" seats for conversion to freight-carrying. Freight loading doors on both sides of fuselage. Rear baggage compartment aft of cabin. Sound, dust and fire-proof insulation. Cabin and instrument lighting, navigation and landing lights. Full instrument equipment including directional gyro and gyro horizon.

DIMENSIONS.—Span 50 ft. 6 in. (15.40 m.), Length 27 ft. 11 in. (8.54 m.), Height 8 ft. 6 in. (2.59 m.).

WEIGHTS.—Weight empty 3,760 lbs. (1,710 kg.), Disposable load 2,690 lbs. (1,220 kg.), Weight loaded 6,450 lbs. (2,930 kg.).

PERFORMANCE.—Maximum speed 180 m.p.h. (290 km.h.), Cruising speed 160 m.p.h. (256 km.h.), Landing speed with flaps 56 m.p.h. (90 km.h.) without flaps 64 m.p.h. (102.4 km.h.), Initial rate of climb 1,240 ft./min. (380 m./min.), Service ceiling 25,000 ft. (7,625 m.), Cruising range 600-1,000 miles (960-1,600 km.).

BOEING.

BOEING AIRCRAFT OF CANADA LTD.

HEAD OFFICE AND WORKS: VANCOUVER, B.C.
President: Stanley Burke.

Boeing Aircraft of Canada Ltd. was formed in 1929 by the Boeing Airplane Company of Seattle, U.S.A.

In 1937 it undertook the manufacture of the Blackburn Shark under licence from Blackburn Aircraft, Ltd. on behalf of the Canadian Department of National Defence. During the last war the company built the Consolidated Vultee Catalina flying-boat for the Canadian Government and the U.S. Navy and also manufactured sub-assemblies for the Canadian-built Mosquito and the Boeing B-29.

With the conclusion of all war contracts the company has disposed of all its Canadian manufacturing facilities and is now inactive.

The C.C.F. Norseman Mk. V Transport Monoplane (550 h.p. Pratt & Whitney Wasp engine).

CANADIAN CAR & FOUNDRY CO., LTD.

HEAD OFFICE: 621, WEST CRAIG STREET, MONTREAL 3, P.Q.
WORKS: ST. LAURENT, P.Q.
President: Victor M. Drury.
Executive Vice-President: William Harty.
Vice-President and General Manager: L. McCoy.

The Canadian Car & Foundry Co. Ltd., the largest manufacturers of railway equipment in the Dominion, entered the Canadian Aircraft Industry by acquiring from the Grumman Aircraft Engineering Corpn., of Bethpage, L.I., N.Y., the licence to construct the Grumman two-seat fighter biplane.

During the late war the Company held contracts with the Canadian Government for the manufacture and assembly of Avro Ansons and for the overhaul and repair of aircraft of various types, including the maintenance and modification of aircraft of the R.A.F. Transport Command.

The Company also had contracts with the British Ministry of Aircraft Production for the manufacture of the Hawker Hurricane for the R.A.F., and with the Departments of Munitions and Supply for the R.C.A.F. Over 1,400 Hurricanes were built. Spares produced were equivalent to well over another 1,000 aircraft.

Canadian Car & Foundry Co. Ltd. was also awarded a contract to build the Curtiss Helldiver single-engined dive-bomber monoplanes under licence from the Curtiss-Wright Corpn. for the U.S. Navy.

The Company is also exclusively licensed in the Dominion of Canada under the Burnelli patents and has developed the prototype of a twin-engined transport which at the time of writing was undergoing flight trials for its Certificate of Airworthiness.

C.C.F. has recently acquired the principal assets of Noorduyn Aviation, Ltd., and will henceforth manufacture the Norseman single-engined general purposes aircraft for domestic and export requirements. The current version in production is the Mk. V, an improved version of the Mk. VI which was built by the Noorduyn company during the War for the U.S.A.A.F. as the C-64. The C-64 has since become surplus to military requirements and many aircraft of this type have been sold by the United States in various parts of the World.

THE C.C.F. NORSEMAN Mk. V.

TYPE.—Single-engined Transport.

WINGS.—Strut-braced high-wing monoplane. Two-spar structure in two main sections attached direct to top fuselage longerons and braced to stubs by steel-tube V-struts. Routed, solid or laminated spruce spars with walnut packing under fittings, spruce ribs, steel-tube drag struts and swaged wire-bracing. Duralumin covered leading and trailing-edges, with fabric over remainder. Mass-balanced slotted ailerons have steel-tube frames and fabric covering. Slotted flaps of similar construction between ailerons and fuselage. Wing area 325 sq. ft. (30.2 sq. m.).

FUSELAGE.—Welded chrome-molybdenum steel-tubo framework faired to oval section by steol-tube and steel-channel frames, T-section spruce stringers and fabric covering.

TAIL UNIT.—Wire-braced monoplane type. Tailplane structure as wings. Fin, rudder and elevators have welded steel-tube frames and fabric covering. Controllable trim-tabs in rudder and elevators.

LANDING GEAR.—Fixed two-wheel divided type, consisting of two cantilever air-oil shock-absorber legs attached to faired stubs. Legs may be removed from stubs by removing two bolts each, for substitution of twin standard Edo floats or skis. Floats further supported by V-struts and wire-bracing. Tail-wheel or tail-ski.

POWER PLANT.—One Pratt & Whitney Wasp S3H1 or R-1340-AN-1 nine-cylinder radial air-cooled engine rated at 550 h.p. at 5,000 ft. (1,525 m.). Mounted on detachable bearer, and enclosed in NACA cowling. Hamilton Standard two-blade constant-speed airscrew, with three-blade airscrew optional. Direct electric starter with emergency hand-crank. Two fuel tanks with total capacity of 120 U.S. gallons (454 litres) in wing roots with gravity feed to engine-driven pump. One 45 U.S. gallon (170 litre) tank or two 122 U.S. gallon (462 litre) auxiliary fuel tanks may be carried in fuselage below cabin floor. Oil tank of 12 U.S. gallons (45 litres) capacity below fuselage structure.

ACCOMMODATION.—Enclosed cockpit for pilot and co-pilot side-by-side with throw-over or full dual controls. Access door on each side. Below wings is main heated and sound-proofed cabin of 150 cub. ft. (4.24 cub. m.) capacity. Standard arrangements provide for eight passengers on folding or removable bench-type seats (total weight of eight seats with cushions and belts 45 lbs. = 20 kg.), or six upholstered passenger seats (total weight of six seats with cushions and belts 80 lbs. = 36 kg). Alternatively all interior equipment can be removed for freight carrying. Entry door on each side hinged on removable panels to give an opening 43 in. (109 c/m.) wide at floor level when required. Compartment of 20 cub. ft. or auxiliary fuel tank. External access door. Lower part of rear cabin bulkhead may be removed to allow for carriage of long articles of freight (skis, fishing tackle, etc.) in tail fuselage.

DIMENSIONS.—Span 51 ft. 8 in. (15.75 m.), Length (landplane and skiplane) 32 ft. 4 in. (9.86 m.), Length (seaplane) 34 ft. 3 in. (10.44 m.), Height 10 ft. 1 in. (3.07 m.).

WEIGHTS AND LOADINGS (Landplane).—Weight empty (without seats and radio) 4,250 lbs. (1,928 kg.), Disposable load 3,150 lbs. (1,429 kg.), Weight loaded 7,400 lbs. (3,357 kg.), Wing loading 22.7 lbs./sq. ft. (100.77 kg./sq. m.), Power loading 13.4 lbs./h.p. (6.1 kg./h.p.).

WEIGHTS AND LOADINGS (Seaplane).—Weight empty 4,700 lbs. (2,132 kg.), Disposable load 2,840 lbs. (1,288 kg.), Weight loaded 7,540 lbs. (3,420 kg.), Wing loading 23.2 lbs./sq. ft. (113.22 kg./sq. m.), Power loading 13.6 lbs./h.p. (6.16 kg./sq. m.).

WEIGHTS AND LOADINGS (Skiplane).—Weight empty 4,435 lbs. (2,012 kg.), Disposable load 2,965 lbs. (1,345 kg.), Weight loaded (with winter nose cowl) 7,400 lbs. (3,357 kg.), Wing and power loadings as Landplane.

PERFORMANCE (Landplane).—Maximum speed 155 m.p.h. (248 km.h.) at 5,000 ft. (1,525 m.), Cruising speed (66% power) 141 m.p.h. (227 km.h.) at 5,000 ft. (1,525 m.), Landing speed 68 m.p.h. (109 km.h.), climb to 5,000 ft. (1,525 m.) 7 minutes, Service ceiling 17,000 ft. (5,185 m.), Normal range 464 miles (747 km.).

PERFORMANCE (Seaplane).—Maximum speed 155 m.p.h. (248 km.h.) at 5,000 ft. (1,525 m.), Cruising speed (66% power) 134 m.p.h. (216 km.h.) at 5,000 ft. (1,525 m.), Alighting speed 69 m.p.h. (111 km.h.), Climb to 5,000 ft. (1,525 m.) 9 minutes, Service ceiling 14,000 ft. (5,270 m.), Normal range 442 miles (712 km.).

PERFORMANCE (Skiplane).—Maximum speed 160 m.p.h. (248 km.h.) at 5,000 ft. (1,525 m.), Cruising speed (66% power) 138 m.p.h. (222 km.h.), Landing speed 68 m.p.h. (109 km.h.), Climb to 5,000 ft. (1,525 m.) 7 minutes, Service ceiling 17,000 ft. (5,185 m.), Normal range 464 miles (747 km.).

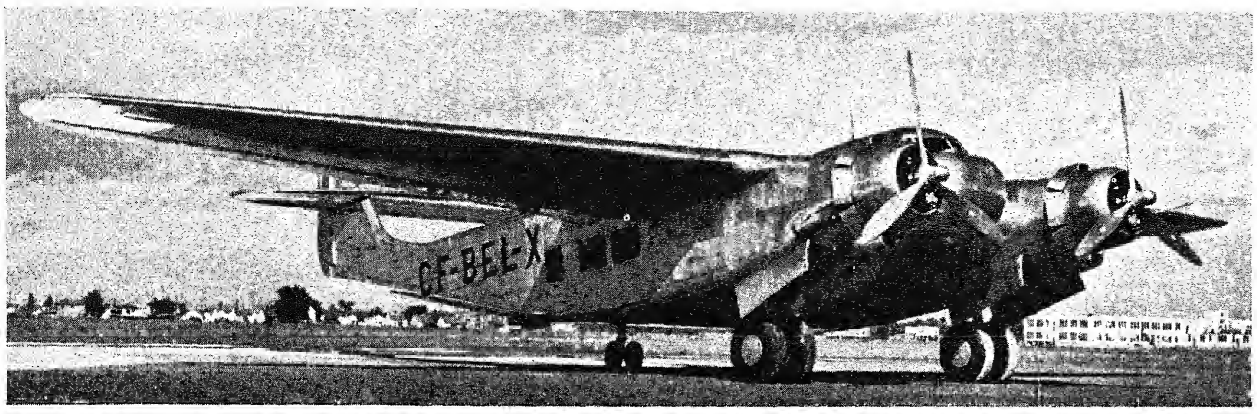
THE C.C.F. BURNELLI CBY-3.

TYPE.—Twin-engined twin-boom "Lifting Fuselage" Transport.

WINGS.—Cantilever high-wing monoplane. All-metal two-spar structure consisting of two tapered outer wings attaching to sides of fuselage. Detachable tips. Spars continue through fuselage and are swept-back in outer wings. Dihedral 4 degrees. Root chord 14 ft. 6 in. (4.42 m.), Projected tip chord 4 ft. 10 in. (1.47 m.), Maximum depth 2 ft. 7 in. (0.79 m.). Ailerons (with trim-tab in each) and flaps carried on rear spar. Aileron span 19 ft. 1 in. (5.82 m.), Aileron area (each) 46 sq. ft. (4.27 sq. m.), flap span 11 ft. 11 in. (3.63 m.), Flap area (each 46.7 sq. ft. (4.34 sq. m.). Auxiliary flap under fuselage with chord of 2 ft. (0.61 m.). Flap positions 20 degrees for take-off and 60 degrees for landing. Gross wing area 629 sq. ft. (58.42 sq. m.).

FUSELAGE.—All-metal structure of aerofoil section with flat sides, carrying crew nacelle and engines at forward end and with twin booms extending aft to carry tail-unit. Maximum fuselage width 20 ft. (6.1 m.), Length 30 ft. 3 in. (9.21 m.), Maximum depth 7 ft. (2.13 m.), Width of booms 1 ft. (0.305 m.). Total lifting area of fuselage 605 sq. ft. (56.2 sq. m.).

TAIL UNIT.—All-metal structure carried on twin booms extending rearward from outer sides of fuselage. Twin fins and rudders with high-set tailplane between and extending outside booms, and three balanced elevators, one between booms and two outer elevators.



The Prototype C.C.F. Burnelli CBY-3 Twin-engined Transport Monoplane (two 1,200 h.p. Pratt & Whitney Twin-Wasp engines).

Trim-tabs in rudders and elevators. Fin area (each) 34.7 sq. ft. (3.22 sq. m.), Rudder height 9 ft. 6 in. (2.89 m.), Maximum rudder chord 3 ft. 1½ in. (0.95 m.), Rudder area (each) 27.1 sq. ft. (2.52 sq. m.), Rudder tab area (each) 1.7 sq. ft. (0.16 sq. m.), Tailplane span 33 ft. 6 in. (10.2 m.), Tailplane and elevator chord 7 ft. 3 in. (2.21 m.). Tailplane area 128.8 sq. ft. (12.95 sq. m.), Main elevator span 16 ft. 5 in. (5 m.), Chord 2 ft. 6¼ in. (0.77 m.), Total elevator area 82 sq. ft. (7.62 sq. m.), Tab area 3.8 sq. ft. (0.35 sq. m.).

Landing Gear.—Retractable type. Each main unit, consisting of twin 15.00 × 16 wheels carried on single levered-suspension shock-absorber leg, retracts forward into engine nacelles and is enclosed by twin doors. Twin shock-absorber legs with single wheel optional on each unit. Hydraulic operation, with emergency gear. Hydraulic brakes. Track (centre-line of legs) 15 ft. 8 in. (4.77 m.). Tail-wheel, on shock-absorber leg attached at rear of fuselage on centre-line, retracts forward into fuselage.

Power Plant.—Two 1,200 h.p. Pratt & Whitney R-1830-S1C3-6 fourteen-cylinder two-row radial air-cooled engines mounted on bearers projecting forward from fuselage structure and enclosed in long-chord cowlings with trailing-edge cooling gills. Three-blade airscrews 12 ft. (3.66 m.) diameter, clearance 16 in. (40.6 c/m.). Engine centres 15 ft. 8 in. (4.77 m.). Fuel tanks in inboard ends of wings, with total capacity of 750 U.S. gallons (2,839 m.), Oil capacity 40 U.S. gallons (151 litres).

Accommodation.—Crew of three in nacelle slightly above and forward of main fuselage structure. Pilots in front with radio compartment immediately behind. Main cabin 19 ft. long × 20 ft. wide × 6 ft. 6 in. high (5.79 × 6.1 × 1.98 m.) is situated towards rear of fuselage and has normal accommodation for 22 passengers, or 38 with forward freight compartment removed. Floor area 198 sq. ft. (18.39 sq. m.), Capacity 1,170 cub. ft. (33.11 cub. m.). Entry door 2 ft. 2 in. (0.66 m.) wide on each side of fuselage aft of wing trailing-edge. Toilet compartment and galley centrally-placed at rear. Main freight compartment in fuselage between spars with floor area of 123 sq. ft. (11.41 sq. m.) and capacity of 717 cub. ft. (20.28 cub. m.). Access door 6 ft. × 4 ft. (1.83 × 1.22 m.) on each side. Two baggage compartments at rear, one on either side of tail-wheel compartment, and two forward compartments, one on either side of crew nacelle, with total capacity of 298 cub. ft. (8.42 cub. m.).

Dimensions.—Span 86 ft. 0 in. (26.2 m.), Length overall 54 ft. 6½ in. (16.61 m.), Height (tail down, over rudder) 13 ft. 4 in. (4.06 m.).

Weights and Loadings (Designed).—Weight empty 16,800 lbs. (7,620 kg.), Passengers and baggage 4,490 lbs. (2,037 kg.), Freight 440 lbs. (200 kg.), Crew of three 470 lbs. (213 kg.), Fuel and oil 4,800 lbs. 2,177 kg.), Weight loaded 27,000 lbs. (12,247 kg.), Wing loading (computed on combined lifting area of wing and fuselage) 21.83 lbs. sq. ft. (105.52 kg./sq. m.), Power loading 11.27 lbs./h.p. (5.1 kg./h.p.).

Performance (Estimated).—Maximum speed 221 m.p.h. (356 km.h.) at 10,000 ft. (3,050 m.), Speed at sea level 206 m.p.h. (332 km.h.), Cruising speed 193 m.p.h. (311 km.h.) at 10,000 ft. (3,050 m.), Stalling speed (at 24,000 lbs. = 10,886 kg.) 65 m.p.h. (105 km.h.), Rate of climb at sea level 980 ft./min. (300 m./min.), Absolute ceiling 19,400 ft. (5,915 m.), Cruising range 1,200 miles (1,930 km.), Cruising duration 7 hours.

CANADAIR.

CANADAIR LTD.

Head Office and Works: Cartierville, Montreal, P.Q.

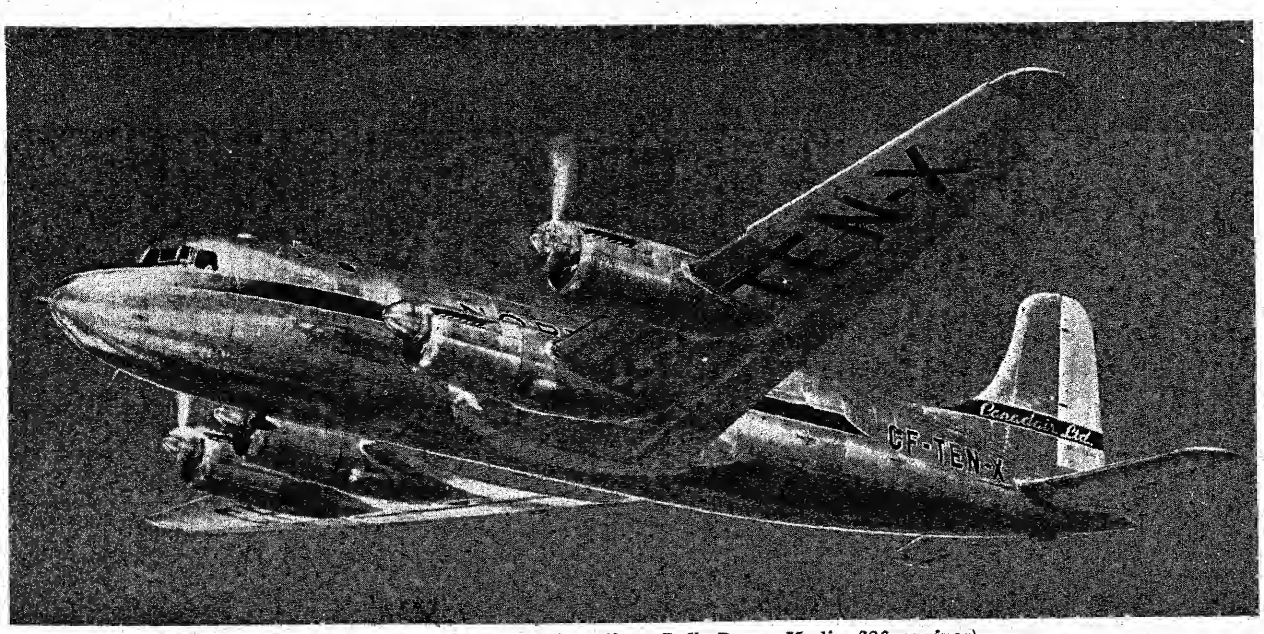
President and General Manager: H. Oliver West.

Chief Engineer: P. W. Gooch.

Canadair, Ltd., was formed in December, 1944, by the separation of the Aircraft Division of Canadian Vickers, Ltd. from the parent Company and its formation into a new Company to be solely responsible for the manufacture of aircraft. Canadian Vickers, Ltd. will devote its entire facilities in the future to shipbuilding.

In 1947 it was announced that Canadair, Ltd. had been acquired by the Electric Boat Co., of New York, one of the largest builders of submarines in the World, but a company which had not previously engaged in aircraft manufacture. The deal includes the transfer of the Canadian Governments rights in the DC-4 to the new owners.

In the years before the war Canadian Vickers, Ltd. was engaged in the design and development of special types and the adaptation of existing types of aircraft to suit the special requirements of Canada. It made a speciality of winter landing equipment embodying the experience which the long snow period in Canada



The Canadair DC-4M.1 Airliner (four Rolls-Royce Merlin 620 engines).

CANADAIR—*continued.*

afforded and float equipment which is essential for summer operations among the lakes and rivers of Northern Canada.

During the war Canadian Vickers undertook extensive contracts in the manufacture of military aircraft for both the Canadian and United States Governments, details of which have been given in previous issues of this Annual.

Canadair, Ltd. is building the Douglas DC-4 and it has been and still is engaged in an extensive C-47—DC-3 conversion programme for airlines in many parts of the World. The Canadair DC-4M is being produced for use by Trans-Canada Airlines. A provisional order of twelve for use by the R.C.A.F. as transports has been cancelled.

THE CANADAIR DC-4M.

The DC-4M is a modified version of the standard Douglas DC-4 and conforms to the specified requirements of Trans-Canada Airlines. The major requirement in the T.C.A. specification called for the use of the Rolls-Royce Merlin liquid-cooled engine, with which T.C.A. has had extensive experience on trans-Atlantic service. To meet the Canadian specification the aircraft can be regarded as being 40% re-designed, the major design changes to the standard DC-4 being supplied by the Douglas company.

Designed for trans-ocean and international air traffic, the DC-4M has accommodation for 40 passengers and space for about 4,000 lbs. (1,820 kg.) of mail and freight. The power-plant consists of four Merlin 620 liquid-cooled engines in self-contained power nacelles specially developed by Rolls-Royce, Ltd. for this installation.

The first DC-4M.1, which is not pressurized, first flew on July 20, 1946 and has been delivered to Trans-Canada Airlines for service trials. Five more DC-4M.1's are being built. Later aircraft, will be pressurized, will have a 5,000 lb. (2,270 kg.) higher take-off weight, and will be known as the DC-4M.2.

Dimensions.—Span 117 ft. 6 in. (35.8 m.), Length 97 ft. 3 in. (29.7 m.), Height 27 ft. 8 in. (8.4 m.).

Weight Loaded.—78,000 lbs. (35,412 kg.).

Performance.—Maximum speed 353 m.p.h. (565 km.h.) at 23,900 ft. (7,290 m.), Maximum cruising speed 325 m.p.h. (520 km.h.) at 22,600 ft. (6,890 m.), Most economical cruising speed 240-300 m.p.h. (384-480 km.h.) according to operating conditions, Cruising range 3,500 miles (5,600 km.) at 28,000 ft. (8,540 m.), Service ceiling 36,000 ft. (10,980 m.).

CUB.

CUB AIRCRAFT CORPORATION, LTD.

Head Office and Works: Hamilton, Ontario.
President and Managing Director: Russell L. Gibson.
Secretary and Treasurer: J. M. McGill.
Factory Manager and Chief Engineer: John F. Gibson.

The Cub Aircraft Corpn. was formed in 1937 to assemble and later to manufacture the American Piper Cub under licence from the Piper Aircraft Corpn. of Lock Haven, Pa., U.S.A.

Since the war the company has resumed its civil activities and is now in production with the Cub Prospector.

The Prospector is similar to the Piper Cub J-3 but the interior has been modified to meet Canadian needs. The rear seat is easily removable and the baggage compartment has been extended to permit the loading of bulky articles.

DE HAVILLAND.

THE DE HAVILLAND AIRCRAFT OF CANADA, LTD.

Head Office and Works: Postal Station "L," Toronto, Ontario.
Managing Director: P. C. Garratt.
Executive Director: H. R. Smyth.
Engineering Director: W. D. Hunter.
Chief Designer: W. J. Jakimuik.
Works Manager: W. A. R. Calder.
Secretary and Treasurer: G. J. Mickleborough.

The de Havilland Aircraft of Canada, Ltd., was established early in 1928 by the de Havilland Aircraft Co., Ltd., as a Canadian constructional plant and service depôt for D.H. aircraft.

The authorised capital of the Company is $500,000, of which $300,000 has been issued and four-fifths is held by Canadian investors.

Considerable experimental work has been done in order to produce components and special accessories to meet all Canadian flying conditions.

The Company began the manufacture of the Tiger Moth in 1937 and from then until 1942 it built in all 1,520. Thereafter it concentrated on Mosquito production and by the end of the war it had turned out 1,034.

Since the end of the war the company has flown its first aircraft of original design—the Chipmunk—and has gone into production with a modernised version of the D.H. Fox Moth. Both these aircraft are described below. Conversion work on Cessna, Norseman, Canso and Catalina aircraft is also in hand.

THE D.H.C.1 CHIPMUNK.

The Chipmunk was originally conceived in October, 1945, as a replacement type for the Canadian D.H. Tiger Moth, and also for use as a private owner's aircraft. The prototype Chipmunk, which first flew in May, 1946, is equipped with a D.H. Gipsy Major Ic four-cylinder in-line inverted air-cooled engine rated at 142 h.p. at 2,400 r.p.m. and driving a fixed-pitch airscrew, but production aircraft will have the Gipsy Major 30 engine and a variable-pitch airscrew.

A variation known as the D.H.C.2 will have a wider fuselage to allow for side-by-side seating, with an optional third seat behind and will use the same wings and tail-unit as the D.H.C.1. This version may be fitted with a retractable landing-gear.

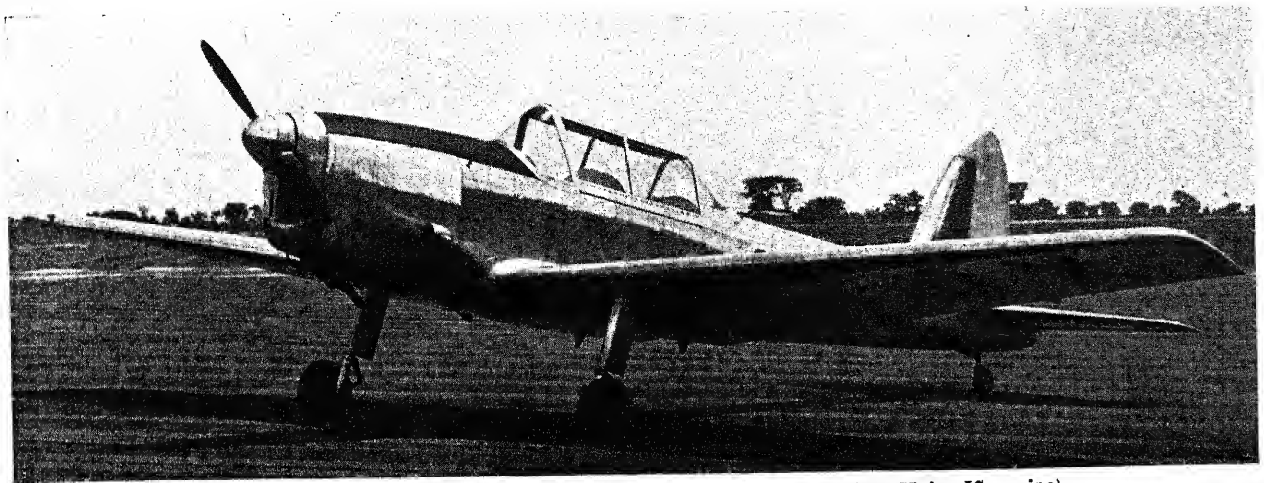
Type.—Two-seat Trainer.

Wings.—Cantilever low-wing monoplane. High-lift aerofoil section based on NACA 2415 and U.S.A.35B, with increased camber towards tips. All-metal single-spar structure in two main sections each attached to fuselage by three bolts. Spar of sheet metal, with stressed-skin D-section leading-edge, built-up metal ribs and metal trailing-edge. Fabric covering aft of spar. Auxiliary spar carries ailerons and flaps. Strengthened at hinge points. Aspect ratio 6.82; taper ratio 2.1; incidence 2 degrees; dihedral 5 degrees; root chord 6 ft. 7.3 in. (2.01 m.); mean chord 5 ft. 0 in. (1.52 m.). Metal-framed fabric-covered slotted ailerons with metal trim-tab in each adjustable on ground. Aileron area (total) 14 sq. ft. (1.3 sq. m.). All-metal slotted flaps between ailerons and fuselage. Flap area 22 sq. ft. (2.03 sq. m.). Gross wing area 172.5 sq. ft. (16.01 sq. m.).

Fuselage.—All-metal semi-monocoque structure in two sections joined aft of rear cockpit. Forward section incorporates cockpits and wing attachments and has four main longerons, ring formers and longitudinal stringers and stressed metal skin. Rear section

The D.H.C.1 Chipmunk Two-seat Training Monoplane (D.H. Gipsy Major IC engine).

DE HAVILLAND—*continued.*



The D.H.C.1 Chipmunk Two-seat Training Monoplane (D.H. Gipsy Major IC engine).

is metal monocoque ending in rear bulkhead, to which main tail-unit members are attached, and conical tail-piece. Maximum fuselage depth (over cabin) 4 ft. 6 in. (1.37 m.), Maximum width 2 ft. 6 in. (0.76 m.).

TAIL UNIT.—All-metal cantilever monoplane type, constructed as wings. Fin post and tailplane spar attached to rear fuselage bulkhead. Aerodynamically-balanced rudder and elevators, with fabric covering and metal trim-tab in each. Rudder tab adjustable on ground, elevator tabs controllable from cockpits. Tailplane span 11 ft. 11 in. (3.63 m.), elevator area (total) 14 sq. ft. (1.3 sq. m.); tailplane area 17 sq. ft. (1.57 sq. m.); total horizontal area 31 sq. ft. (2.87 sq. m.); rudder area 6.5 sq. ft. (0.6 sq. m.); fin area 5.9 sq. ft. (0.54 sq. m.); total vertical area 12.4 sq. ft. (1.14 sq. m.).

LANDING GEAR.—Fixed two-wheel type. Each main wheel carried on outside of single cantilever strut incorporating rubber shock-absorption and enclosed in light metal fairing. Track 8 ft. 9 in. (2.66 m.). Tail-wheel carried on levered-suspension strut, with rubber shock absorption.

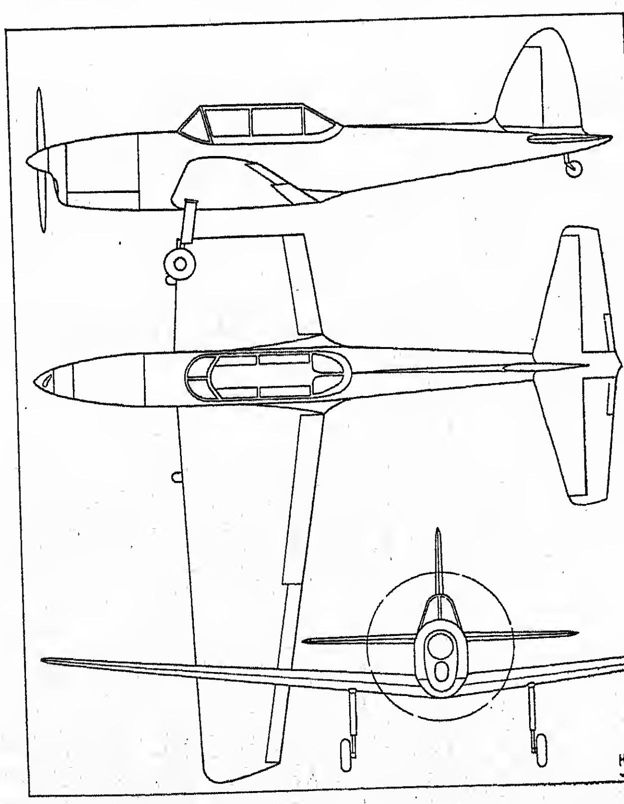
POWER PLANT.—One 140 h.p. D.H. Gipsy Major 30 four-cylinder in-line inverted air-cooled engine mounted on bearers composed of two formed sheet alloy beams supported by steel-tubes attached to lower longerons. Cowling in three hinged sections. Two-blade variable-pitch airscrew. Fuel capacity 28 Imp. gallons (127 litres) in two wing tanks. Oil tank of 3½ Imp. gallons (16 litres).

ACCOMMODATION.—Two cockpits in tandem with removable canopy, portions of which slide for access. Dual controls.

DIMENSIONS.—Span 34 ft. 4 in. (10.45 m.), Length 25 ft. 8 in. (8.13 m.), Height 7 ft. 1 in. (2.15 m.).

WEIGHTS AND LOADINGS (Designed).—Weight empty 1,175 lbs. (533 kg.), Weight loaded 1,780 lbs. (807 kg.), Wing loading 10.3 lbs./sq. ft. (50.29 kg./sq. m.), Power loading 14.3 lbs./h.p. (6.47 kg./h.p.).

PERFORMANCE (Prototype with Gipsy Major Ic.).—Maximum speed 145 m.p.h. (233 km.h.), Cruising speed 130 m.p.h. (209 km.h.), Stalling speed (flaps up) 45 m.p.h. (72 km.h.), Stalling speed with flaps at 40 degrees, 40 m.p.h. (64 km.h.), Rate of climb 1,000 ft./min., (305 m./min.,) Range 580 miles (933 km.), Maximum landing distance from 50 ft. (15 m.) 500 yds. (457 m.).



The D.H.C.1 Chipmunk.

THE D.H. 83C FOX MOTH.

The D.H.83C Fox Moth is the Canadian version of the D.H.83 which was originally produced in Great Britain by the parent company in 1932. The new version (recently re-introduced after production had ceased several years ago) is basically the same as the earlier aircraft, but is equipped with a 140 h.p. D.H. Gipsy Major Ic engine. A variable-pitch airscrew will be fitted to later aircraft. Other refinements include a sliding canopy over the pilot's cockpit; a larger cabin door for loading freight; improved cabin heating and ventilation, and greater luggage capacity. Improved methods of plywood construction have been introduced as a result of experience with the Mosquito.

TYPE.—Four-passenger cabin biplane.

WINGS.—Equal-span single-bay braced biplane. Aerofoil section R.A.F.15. Wings are two-spar structures each built in two main sections, the upper wings attaching to centre-section carried above fuselage by splayed-out N-struts, and the lower wings attaching direct to the lower fuselage longerons. Wings are standard D.H. 82 Tiger Moth components altered to conform to Fox Moth specifications. Solid spruce I-section spars, spruce ribs and fabric covering. Sweepback 7 in. (17.8 c/m.) at tip; stagger 3½ in. (8.9 c/m.), Chord 4 ft. 4⅜ in. (1.33 m.), Gap 5 ft. 4 in. (1.62 m.). Fabric-covered wooden ailerons on lower wings only. Aileron area (total 22.4 sq. ft. (2.06 sq. m.). Gross wing area 247 sq. ft. (22.9 sq. m.).

FUSELAGE.—Spruce structure consisting of four main longerons and vertical frames with plywood covering, over which is a covering of fabric. All wooden parts protected by nitro-cellulose finish. Phenol-formaldehyde resin employed in manufacture of plywood; urea-formaldehyde used in all primary and secondary gluing. All steel fittings are cadmium plated and all aluminium fittings have anti-corrosion anodising.

TAIL UNIT.—Monoplane type. Standard D.H. 82 Tiger Moth components modified to Fox Moth specifications. Wooden structure with fabric covering. Cantilever fin and horn-balanced rudder. Tailplane is braced to fuselage by single steel-tube strut on each side. Controllable elevator trim-tabs. Tailplane span (overall) 9 ft. 10 in. (3.0 m.), Tailplane chord (root) 2 ft. 9 in. (0.84 m.), Tailplane area 13.4 sq. ft. (1.22 sq. m.), Maximum elevator chord 1 ft. 10 in. (0.56 m.), Elevator area (total) 13.8 sq. ft. (1.26 sq. m.), Fin area 2.8 sq. ft. (0.25 sq. m.), Rudder area 9.4 sq. ft. (0.86 sq. m.).

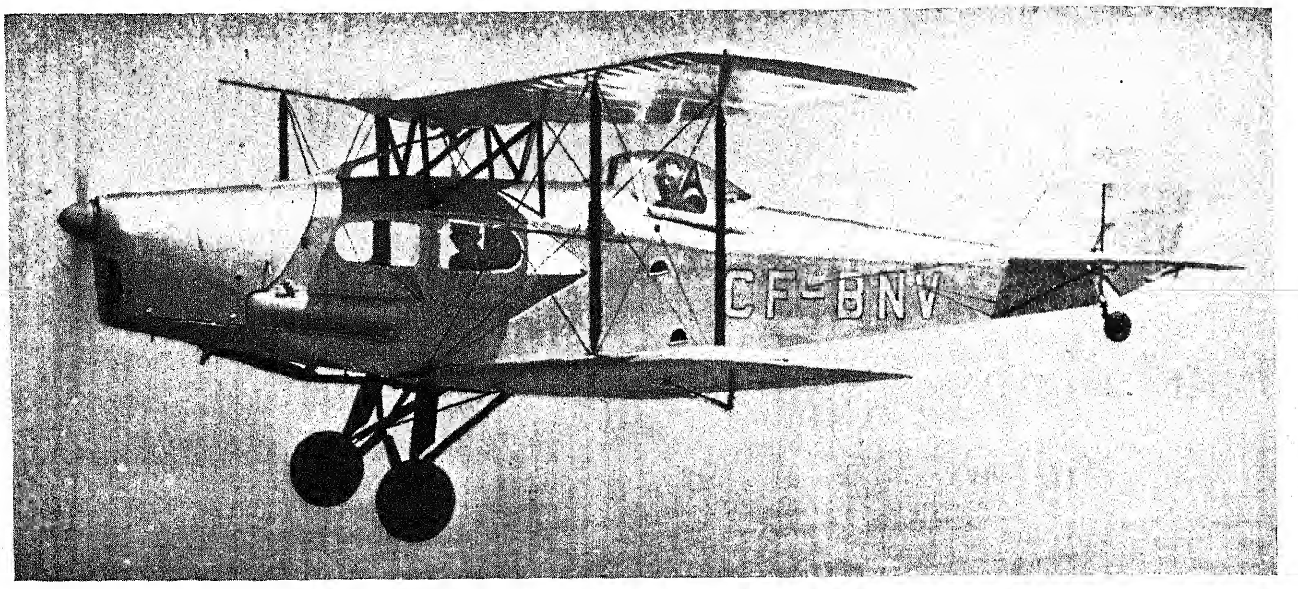
LANDING GEAR.—Fixed two-wheel type. Each main wheel 19 in. × 7 in. (482 mm. × 178 mm.) carried on steel-spring shock-absorber strut attached to bottom longerons; rearward-sloping radius-rod and half-axle attached to steel-tube V-structure under fuselage. Track 6 ft. (1.83 m.). Bendix wheel-brakes and parking brakes. Full-castering tailwheel with pneumatic tyre. Twin Edo 2425 floats or de Havilland 83006 skis may be fitted. Attachment points fitted on standard aircraft.

POWER PLANT.—One de Havilland Gipsy Major IC four-cylinder in-line inverted air-cooled engine developing 140 h.p. at 2,400 r.p.m. De Havilland 5220/SC two-blade fixed-pitch wooden, or Fairey-Reid 94103A/X1 manually-operated variable-pitch metal airscrew, 6 ft. 9 in. (2.06 m.) diameter. Two-piece hinged cowling. Fuel tank in upper wing centre-section with capacity of 25 Imp. gallons (114 litres), Auxiliary fuel tank of 25 Imp. gallons (114 litres) capacity may be installed in luggage compartment at rear of passenger cabin. Oil tank of 2 Imp. gallons (9 litres) capacity or 3 Imp. gallons (13.6 litres) capacity when auxiliary fuel tank installed.

ACCOMMODATION.—Pilot's cockpit aft of wings with sliding Plexiglas canopy. Enclosed cabin 5 ft. 3 in. long × 2 ft. 9 in. wide × 3 ft. 6 in. high (1.6 m. × 0.84 m. × 1.06 m.) has capacity of 49.3 cub. ft. (1.39 cub. m.) and seats three passengers, two side-by-side in hammock-type seat facing forward and one facing aft on chair-type seat. Seats removable to allow for carriage of freight. Access door on each side of cabin, with sliding windows. Port door measures 3 ft. 5½ in. wide × 3 ft. high (1.05 m. × 0.91 m.) to allow for freight loading. Metal side walls optional. Cabin floor reinforced for heavy cargo. Luggage carried under floor of pilot's cockpit, on rack at rear of cabin and beside rear-facing passenger.

DIMENSIONS.—Span 30 ft. 10⅝ in. (9.4 m.), Length (landplane and ski-plane) 25 ft. 9 in. (7.86 m.), Height 8 ft. 4⅜ in. (2.56 m.).

DE HAVILLAND—continued.



The D.H. 83C Fox Moth Four-seat Cabin Biplane (140 h.p. D.H. Gipsy Major IC engine).

Weights and Loadings (Landplane).—Weight empty (equipped) 1,219 lbs. (552 kg.), Pilot 170 lbs. (77 kg.), Fuel and oil 201 lbs. (91 kg.), Payload 510 lbs. (233 kg.), Weight loaded 2,100 lbs. (953 kg.), Wing loading 8.5 lbs./sq. ft. (41.4 kg./sq. m.), Power loading 15 lb./h.p. (6.7 kg./c.v.).

Weights and Loadings (Seaplane).—Weight empty (equipped) 1,444 lbs. (656 kg.), Pilot 170 lbs. (77 kg.), Fuel and oil 201 lbs. (91 kg.), Payload 399 lbs. (180 kg.), Wing loading 9 lbs./sq. ft. (43.94 kg./sq. m.), Power loading 15.8 lbs./h.p. (7.24 kg./c.v.).

Weights and Loadings (Skiplane).—Weight empty (equipped) 1,258 lbs. (571 kg.), Pilot 170 lbs. (77 kg.), Fuel and oil 201 lbs. (91 kg.), Payload 471 lbs. (214 kg.), Wing and power loadings as Landplane.

Performance (Landplane).—Maximum speed 110 m.p.h. (177 km.h.), at sea-level, Speed at 5,000 ft. (1,525 m.) 101 m.p.h. (162 km.h.), Speed at 10,000 ft. (3,050 m.) 88 m.p.h. (142 km.h.), Cruising speed 96 m.p.h. (155 km.h.) at 2,100 r.p.m., Stalling speed 52 m.p.h. (84 km.h.), Rate of climb at sea level 525 ft./min. (160 m./min.), Climb to 5,000 ft. (1,525 m.) 12 minutes, Climb to 10,000 ft. (3,050 m.) 29 minutes, Service ceiling 10,500 ft. (3,200 m.), Absolute ceiling 12,300 ft. (3,750 m.), range at cruising speed (with 25 Imp. gallons = 114 litres fuel) 375 miles (605 km.), (with 35 Imp. gallons = 159 litres fuel) 525 miles (845 km.), (with 50 Imp. gallons = 228 litres fuel) 750 miles (1,208 km.), Take-off run 256 yds. (234 m.), Landing run (with brakes) 150 yds. (137 m.), (without brakes) 163 yds. (149 m.), Fuel consumption at cruising speed 6.4 Imp. gallons per hr. (29 litres per hr.).

Performance (Seaplane).—Maximum speed 96 m.p.h. (155 km.h.) at sea level, Speed at 5,000 ft. (1,525 m.) 88 m.p.h. (142 kmh.), Speed at 10,000 ft. (3,050 m.) 77 m.p.h. (124 km.h.), Cruising speed 84 m.p.h. (135 km.h.) at 2,100 r.p.m., Stalling speed 54 m.p.h. (87 km.h.), Rate of climb at sea level 450 ft./min. (137 m./min.), Climb to 5,000 ft. (1,525 m.) 18 minutes, Climb to 10,000 ft. (3,050 m.) 35 minutes, Service ceiling 9,000 ft. (2,740 m.), Absolute ceiling 11,000 ft. (3,350 m.), Range at cruising speed (with 25 Imp. gallons = 114 litres fuel) 328 miles (529 km.), (with 35 Imp. gallons = 159 litres fuel) 460 miles (740 km.), (with 50 Imp. gallons = 228 litres fuel) 656 miles (1,058 km.), Take-off time 30 seconds, Fuel consumption at cruising speed 6.4 Imp. gallons per hr. (29 litres per hr.)

Performance (Skiplane).—Maximum speed 108 m.p.h. (174 km.h.) at sea level, Speed at 5,000 ft. (1,525 m.) 99 m.p.h. (160 km.h.), Speed at 10,000 ft. (3,050 m.) 86 m.p.h. (138 km.h.), Cruising speed 94 m.p.h. (151 km.h.) at 2,100 r.p.m., Stalling speed 52 m.p.h. (84 km.h.), Rate of climb at sea level 510 ft./min. (155 m./min.), Climb to 5,000 ft. (1,525 m.) 14 minutes, Climb to 10,000 ft. (3,050 m.) 31 seconds, Service ceiling 10,000 ft. (3,050 m.), Absolute ceiling 12,000 ft. (3,660 m.), Range at cruising speed (with 25 Imp. gallons = 114 litres fuel) 368 miles (592 km.), (with 35 Imp. gallons = 159 litres fuel) 515 miles (930 km.), (with 50 Imp. gallons = 228 litres fuel) 735 miles (1,183 km.), Take-off time 15 seconds, Fuel consumption 6.4 Imp. gallons per hr. (29 litres per hr.).

FAIRCHILD.

FAIRCHILD AIRCRAFT LTD.

Head Office and Works: Longueuil, P.Q.

President and Managing Director: H. M. Pasmore.

Executive Vice-President: R. B. Irvine.

Vice-Presidents: Howard Murray, O.B.E. and W. Taylor-Bailey.

Secretary: F. Bindoff.

Treasurer: D. H. Sutherland.

Fairchild Aircraft, Ltd., is a direct outgrowth of the aviation activities of the St. Maurice Valley Protection Association which began operations in 1919 and was the first concern to demonstrate that it was practical to use aircraft for commercial purposes in the Dominion. From the St. Maurice Association was formed Fairchild Aerial Surveys of Canada, Ltd., in 1922, and in 1929, Fairchild Aircraft, Ltd., was formed to act solely as a manufacturing and servicing organization.

The factory, built in September, 1930, comprised 38,000 square feet of floor space. Extensions to date now total over 600,000 square feet with machinery and equipment installed valued at approximately $2,000,000.

The Company, in association with five other Canadian aircraft manufacturers, was awarded a contract by the British Air Ministry for the manufacture of twin-engined Hampden bombers. Certain specific components for the Hampden were built by Fairchild. Manufacture started in June, 1939, and the contract was completed in the early part of 1942.

It has also completed a contract with the Canadian Government for the manufacture of Bristol Bolingbroke twin-engined monoplanes. The Bolingbroke was generally similar to the Bristol Blenheim IV. The landing-gear could be fitted with either wheels, floats or skis. Some were fitted with the Boulton Paul power-operated gun turret for use as trainers for air-gunners.

In addition to the production of the Bolingbroke, the Company built the Curtiss Helldiver for the U.S. Navy under licence from the Curtiss-Wright Aircraft Corporation. The U.S. Navy contract was placed in October, 1942, and the first Fairchild-built Helldiver flew on August 28, 1943. This contract was completed in April, 1945.

With the cancellation of all war contracts in August, 1945, Fairchild Aircraft, Ltd. began the development of a specialised freight-carrying aeroplane suitable for Canadian conditions. This aircraft, the Fairchild Husky, was completed in 1946. It is described below.

THE FAIRCHILD F-11 HUSKY.

The F-11 Husky was designed as a replacement type for the Fairchild 71 and 82 transport monoplanes which were used extensively for bush-flying in Canada and although a float, wheel or ski landing gear can be fitted, it is intended primarily for operation as a seaplane. The prototype F-11, made its first flight from the St. Lawrence River near Montreal in June, 1946. Production was expected to begin in September, 1946, and to reach an ultimate output of one per week early in 1947.

Type.—Single-engined Transport.

Wings.—Strut-braced high-wing monoplane. All-metal two-spar structure braced to bottom of fuselage by parallel struts. Top surface metal-covered from leading-edge to front spar with fabric covering aft to trailing-edge; bottom surface metal-covered from leading-edge to front spar and from rear spar to trailing-edge, with fabric covering between spars. Spot-welded leading-edge. Fabric-covered metal ailerons. Slotted trailing-edge flaps between ailerons and fuselage. Aspect ratio 8.45; chord 6 ft. 9 in. (2.74 m.); wing area 355 sq. ft. (32.97 sq. m.).

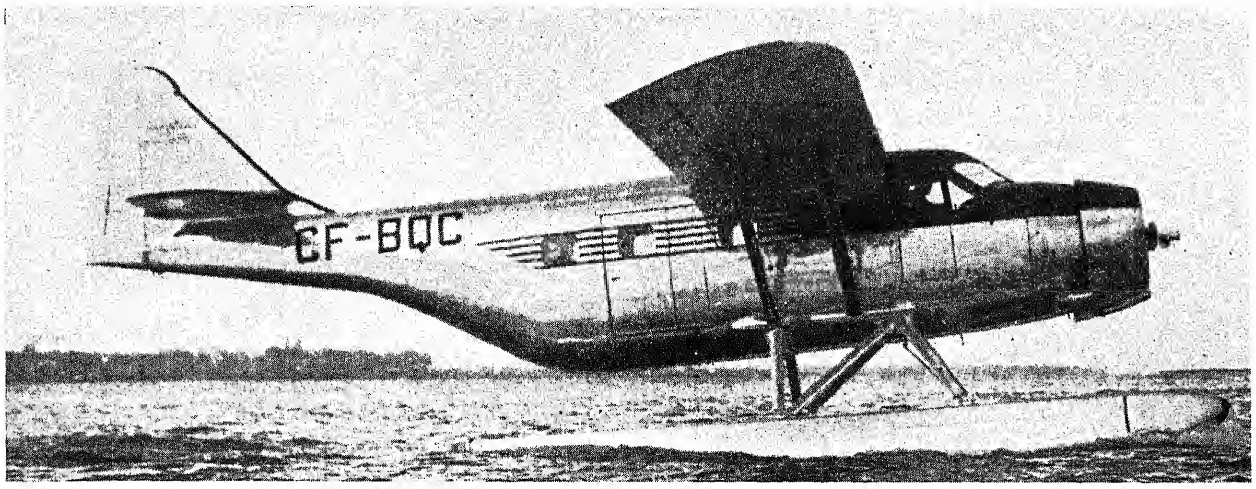
Fuselage.—All-metal structure of oval cross-section; underside of rear portion swept upwards to provide loading door at rear of main cabin. Maximum external depth 6 ft. 6 in. (1.98 m.); maximum width 5 ft. 2 in. (1.57 m.).

Tail Unit.—Cantilever monoplane type. Metal structure with metal-covered fixed surfaces and fabric-covered rudder and elevators. Spot-welded leading-edge to fin and tailplane.

Landing Gear.—Twin Edo metal floats carried on N-struts with spreader-bars and wire-bracing. Alternatively a fixed tricycle landing gear may be fitted, or twin rigidly-mounted skis on pedestals with the aircraft in tail-up position.

Power Plant.—One 450 h.p. Pratt & Whitney R-985-T1B3 or R-985-SB3 Wasp-Junior nine-cylinder radial air-cooled engine driving a two-blade constant-speed metal airscrew.

***FAIRCHILD**—continued.*



The Fairchild Husky Transport Seaplane (450 h.p. Pratt & Whitney Wasp-Junior engine).

Accommodation.—Pilot's compartment ahead of wing leading-edge with seats for two side-by-side with dual controls. Access door 3 ft. 9 in. × 2 ft. 1 in. (1.14 m. × 0.61 m.) on each side. Main cabin 13 ft. long × 5 ft. 1½ in. high (3.96 m. × 1.55 m.) has capacity of 240 cub. ft. (6.79 cub. m.) and can accommodate eight passengers on folding bench-type side-seats or six or seven passengers on individual seats. Floor width 4 ft. 1 in. (1.24 m.). Seats removable so that entire cabin space can be used for freight. Loading door 4 ft. × 3 ft. 4 in. (1.22 m. × 1.02 m.) on each side aft of trailing-edge. Doors are divided horizontally, lower portion hinging on floor line and upper portion opening forward. Rear trapezoidal door is divided vertically and measures 3 ft. 4 in. (1.02 m.) deep and 2 ft. 4½ in. (0.72 m.) wide at top and 3 ft. 4 in. (1.02 m.) wide at bottom. Windows in cabin 12 ins. × 16 in. (30.5 c/m. × 40.6 c/m.), door windows 14 in. × 18 in. (35.5 c/m. × 45.6 c/m.). By using additional space aft two 16 ft. (4.88 m.) or one 18 ft. (5.49 m.) canoes can be carried.

Dimensions.—Span 54 ft. 9 in. (16.69 m.), Length (over fuselage) 37 ft. 5 in. (11.5 m.), Height (tail up) 17 ft. 9 in. (5.41 m.), Height (on float dolly) 13 ft. 0¼ in. (3.96 m.).

Weights and Loadings (Seaplane).—Weight loaded 6,300 lbs. (2,858 kg.), Payload 2,900 lbs. (1,315 kg.), Wing loading 17.75 lbs./sq. ft. (86.66 kg./sq. m.), Power loading 14 lbs./h.p. (6.34 kg./h.p.).

Weights and Loadings (Landplane).—Weight loaded 6,050 lbs. (2,744 kg.), Wing loading 17 lbs./sq. ft. (83 kg./sq. m.), Power loading 13.4 lbs./h.p. (6.07 kg./h.p.).

Performance (Seaplane—fully loaded).—Maximum speed (450 h.p.) 138 m.p.h. (222 km.h.) at 2,300 ft. (700 m.), Cruising speed (300 h.p.) 121 m.p.h. (195 km.h.) at 10,000 ft. (3,050 m.), Stalling speed (without flaps) 67 m.p.h. (108 km.h.), Stalling speed (with 40 degree flap) 58 m.p.h. (94 km.h.), Initial rate of climb 675 ft./min. (206 m./min.), Take-off run, (no wind, 30 degree flap) 733 yds. (670 m.).

FEDERAL.

FEDERAL AIRCRAFT LTD.

Head Office: 276, James Street West, Montreal, P.Q.
President: W. A. Newman, B.Sc.
Vice-President: A. S. Dawes.
General Manager and Treasurer: A. E. Balcombe.
Secretary and Assistant General Manager: G. H. Montgomery, Jr.

Federal Aircraft, Ltd. was formed in July, 1940, as a wholly-owned Government company to supervise the production of the Avro Anson in Canada for use in the Empire Air Training Plan. Eleven Canadian aircraft plants were entrusted with the manufacture and assembly of the major components, Federal Aircraft, Ltd. being responsible for the direction and management of the whole Anson programme.

Under Federal direction a total of 2,882 Ansons was built in Canada; 1,832 Mk. IIs, 1,049 Mk. Vs and one Mk. VI. These Canadian-built Ansons have been described and illustrated in previous issues of this Annual. The last Canadian-built Mk. V Anson was completed early in 1945. MacDonald Bros. Aircraft, Ltd. of Winnipeg has been designated as the continuing contractor for the overhaul and repair of Anson aircraft on behalf of the Royal Canadian Air Force.

Federal Aircraft, Ltd. was formed solely for war purposes and by the time this edition appears the company will probably have surrendered its charter.

FLEET.

FLEET AIRCRAFT LTD.

Head Office, Works and Airport: Fort Erie, Ontario.
Managing Director: T. Y. Smith.
Sales Manager: J. M. Pengelly.
Chief Engineer: G. E. Otter.

Fleet Aircraft, Ltd., is an independent Canadian-owned company and is completely managed by Canadian personnel.

The Company built an up-to-date factory at Fort Erie in 1930 and by 1938-39 this factory had been enlarged to ten times its original size.

The Company took over the complete World's rights from the Consolidated Aircraft Corpn. (U.S.A.), its original parent company, for the Fleet Trainer. It later developed the Model 50K twin-engined freighter and the Model 60 two-seat advanced training monoplane.

The Fleet Trainer, or Finch, was used for primary training in the Commonwealth Air Training Plan. An original order for 404 was completed in 1940 many months ahead of schedule. A further contract for 202 was completed in 1941.

The Model 60, or Fort, was put into production for use as an advanced training type under the Commonwealth Air Training Plan, but on the completion of the 100th machine production ceased on this type in favour of the Fairchild M-62, or Cornell, which had been adopted as the primary trainer in the R.C.A.F. to replace the Fort and the Finch.

The first Cornell was turned out in the Summer of 1942, one month ahead of schedule. Over 1,000 were produced in the first year of production. Owing to curtailment in the Training Programme production of the Cornell was tapered down towards the end of 1943 and finally expired in May, 1944. Thereafter the Company undertook sub-contract work on the Canadian Lancaster production programme.

Since the end of the War the Company has decided to abandon the Finch and Fort designs and to concentrate on the development of new aircraft. Its first post-war design is the Model 80 Canuck, a two-seat light cabin monoplane with an 85 h.p. Continental engine, and the company is now engaged on an initial production programme of 1,500 aircraft. Other types of aircraft are under development.

THE FLEET MODEL 80 CANUCK.

Type.—Two-seat Light Cabin Monoplane.

Wings.—Strut-braced high wing monoplane. Two-spar structure in two sections attached directly to fuselage and braced by streamlined steel-tube struts. Spars have extruded alloy booms with 24ST webs and steel fittings. Ribs of pressed 24ST sheet. Aluminium-alloy tubular drag-struts. Metal leading-edge and fabric covering over remainder. Gross wing area 173.5 sq. ft. (16.12 sq. m.). All-metal mass-balanced ailerons with metal covering.

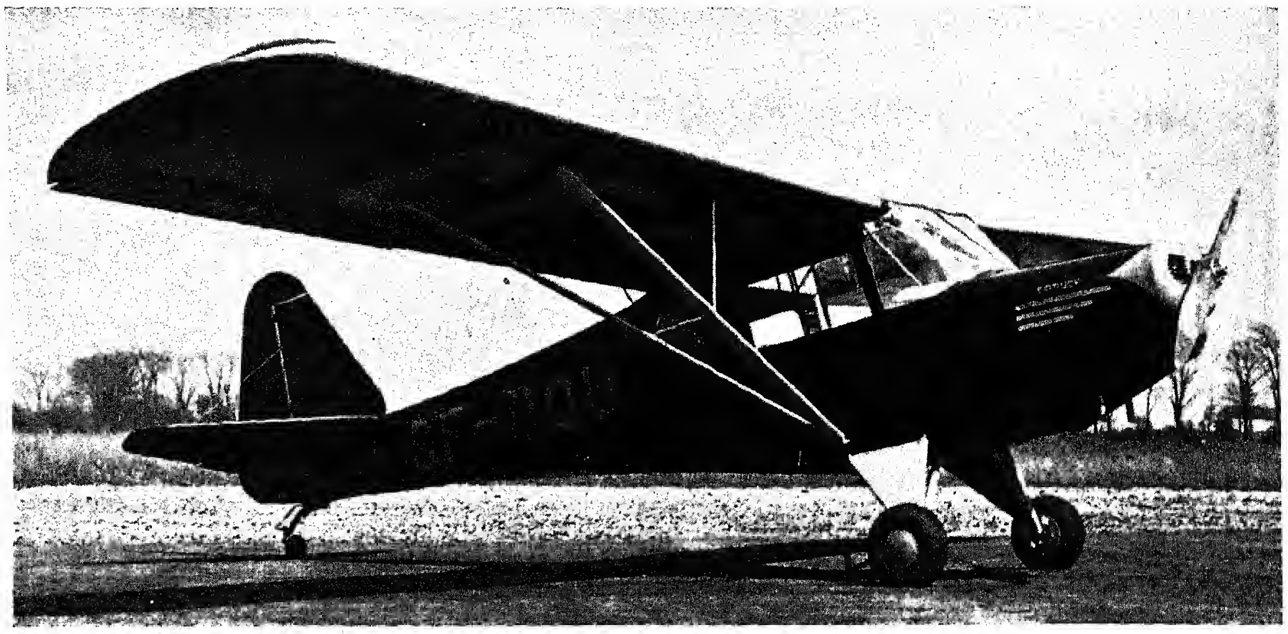
Fuselage.—Welded chrome-molybdenum steel-tubular structure, with light wooden formers and fabric covering. Panels behind fire-wall and front decking of aluminium-alloy.

Tail Unit.—Strut-braced monoplane type. Welded chrome-molybdenum steel structure with fabric covering. Horn-balanced and mass-balanced rudder. Adjustable elevator trim-tab.

Landing Gear.—Fixed two-wheel divided type, consisting of two side vees and half-axles of welded chrome-molybdenum steel tubing hinged to underside of fuselage. Rubber-cord shock-absorbers under cabin floor. Goodyear single-disc hydraulic wheel brakes, toe-operated. Track 6 ft. 1¼ in. (1.85 m.). Scott steerable full-swivelling tail-wheel carried on leaf spring shock-absorber. Twin float or ski landing gear optional.

Power Plant.—One Continental C85-12J four-cylinder horizontally-opposed air-cooled engine rated at 85 h.p. at 2,575 r.p.m., and equipped with Excello fuel-injection system. Two-blade wooden

***FLEET**—continued.*



The Fleet Canuck Two-seat Light Cabin Monoplane (85 h.p. Continental C85-12J engine).

fixed-pitch airscrew, with variable-pitch airscrew optional. 16 Imperial gallon (73 litres) fuel tank in fuselage, with long-range tank of 21 Imperial gallons (95 litres) capacity optional. Oil tank of 1 U.S. gallon (4 litres) capacity attached to engine.

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Adjustable welded steel-tube seat with 16 × 38-in. (41 × 96 cm.) rubber cushion and back. Access by aluminium-alloy door on each side. Plexiglas windscreen and side-panels. Cellulose acetate roof windows. Baggage compartment 36×34×32 in. (91×86×81 cm.) with allowance of 104.5 lb. (48 kg.) behind seats.

DIMENSIONS (Landplane).—Span 34 ft. (10.36 m.), Length 22 ft. 4 in. (6.83 m.), Height 7 ft. 1 in. (2.16 m.).

WEIGHTS AND LOADINGS (Landplane).—Weight empty 858 lbs. (389 kg.), Fuel and oil 122.5 lbs. (55 kg.), Pilot and passenger 340 lbs. (154 kg.), Baggage 104.5 lbs. (48 kg.), Weight loaded 1,425 lbs. (645 kg.), Wing loading 8.2 lbs./sq. ft. (40 kg./sq. m.), Power loading 16.7 lbs./h.p. (7.5 kg./h.p.).

WEIGHTS AND LOADINGS (Seaplane).—As Landplane except weight empty 1,018 lbs. (462 kg.), Baggage 19.5 lbs. (9 kg.), Weight loaded 1,500 lbs. (680 kg.), Wing loading 8.6 lbs./sq. ft. (42 kg./sq. m.), Power loading 17.6 lbs./h.p. (8 kg./h.p.).

WEIGHTS AND LOADINGS (Skiplane).—As Landplane except weight empty 913 lbs. (414 kg.), Weight loaded 1,480 lbs. (672 kg.), Wing loading 8.5 lbs./sq. ft. (41.5 kg./sq. m.), Power loading 17.4 lbs./h.p. (7.88 kg./h.p.).

PERFORMANCE (Landplane).—Maximum speed 111.5 m.p.h. (179 km.h.), Cruising speed (66% power) 100 m.p.h. (161 km.h.), Stalling speed 45 m.p.h. (72 km.h.), Maximum diving speed 160 m.p.h. (257 km.h.), Initial rate of climb 550 ft./min. (158 m./min.), Initial rate of climb (less passenger) 700 ft./min. (213 m./min.), Service ceiling 12,000 ft. (3,660 m.), Range at cruising speed (no reserve) 400 miles (644 km.), Take-off distance in 7 m.p.h. (11 km.h.) wind from asphalt 140 yds. (128 m.), Fuel consumption at cruising speed 25 m.p.g. (8.8 km. per litre).

PERFORMANCE (Seaplane).—Maximum speed 103 m.p.h. (166 km.h.), Cruising speed (66% power) 88 m.p.h. (142 km.h.), Stalling speed 46.5 m.p.h. (75 km.h.), maximum diving speed 160 m.p.h. (257 km.h.), Initial rate of climb 425 ft./min. (130 m./min.), Range at cruising speed (no reserve) 250 miles (563 km.), Fuel consumption 22 m.p.g. (7.7 km. per litre).

PERFORMANCE (Skiplane).—Maximum speed 105.5 m.p.h. (170 km.h.), Cruising speed (66% power) 92 m.p.h. (148 km.h.), Stalling speed 46.5 m.p.h. (75 km.h.), Maximum diving speed 160 m.p.h. (257 km.h.), Initial rate of climb 475 ft./min. (145 m./min.), Range at cruising speed (no reserve) 350 miles (579 km.), Fuel consumption 22.5 m.p.g. (8 km. per litre).

NOORDUYN.

NUCLEAR ENTERPRISES, LTD. (Successors to Noorduyn Aviation, Ltd.).

HEAD OFFICE: P.O. Box 6083, 715, WINDSOR STREET, MONTREAL, P. Q.

In 1946, Noorduyn Aviation, Ltd. was reconstituted under the name Nuclear Enterprises, Ltd. and the manufacture of aircraft and aircraft parts was abandoned. The manufacturing rights for the Noorduyn Norseman were disposed of to the Canadian Car & Foundry Co., Ltd. of Montreal, which company is now in production with the Norseman V. For details of the aircraft see under "C.C.F."

INDIA

HINDUSTAN.

HINDUSTAN AIRCRAFT LTD.

Head Office and Works: Bangalore, Mysore.

Government Aircraft Inspector: E. J. Earle.

Hindustan Aircraft, Ltd. was formed in 1940 to undertake the manufacture of aircraft for the Indian market. With the financial assistance of the Indian Government, the construction, organization and equipment of the factory at Bangalore was undertaken by Mr. William D. Pawley, President of the Inter-continent Corporation of New York, one of the largest exporters of American aircraft to the Far East.

The Intercontinent Corporation was able to acquire a large quantity of machine-tools before the war emergency shortage began to be felt and it later obtained further equipment through the co-operation of the American authorities in Washington. A number of Indian engineers, educated in British and American technical institutions, was engaged to occupy key positions in the factory, working alongside American experts who, it was planned, would be withdrawn after a five-year training period, when the factory would be entirely operated by Indian personnel.

The first aeroplane to be assembled by the factory was flown in August, 1941. This was a Harlow PC-5 two-seat training monoplane of all-metal construction. The Company also assembled two other types of American aircraft and designed and built, from indigenous materials, a 10-seat plywood glider.

On April 2, 1942, it was officially announced that Hindustan Aircraft, Ltd. had been taken over by the Indian Government and that it would be operated, for the period of the War at least, as a Government concern. In September, 1943, the Commanding Officer of the U.S. Army 10th Air Force, was appointed Managing Agent and the Factory was operated by the 10th Air Force until December 15, 1945.

During the War period, it was decided that the Company could be of more benefit to the war effort by concentrating all of its energies on the maintenance, overhaul, and repair of tactical aircraft, engines, and accessories, so the original plans to manufacture and assemble aircraft were dropped. Hindustan's facilities were devoted to American-type aircraft operated by the R.A.F., the Netherlands Air Force, and the U.S. Army Air Forces, but mainly for the last-mentioned. Many hundreds of aircraft were completely overhauled, the main types being Catalina, B-17 Fortress, B-24 Liberator, B-25 Mitchell, C-47 Dakota, and a number of other miscellaneous types. Radial air-cooled engines, running into the thousands, were taken down, cleaned, repaired, inspected, assembled, tested and delivered to the Air Forces. Instruments and accessories running into hundreds of thousands received similar treatment. At its peak load the factory employed over 18,000 Indian personnel.

The capital of the Company had formerly been held jointly by the Government of India, the Mysore Government and Mr. Lalchand Hirachand. Mr. Lalchand Hirachand and his associates accepted the offer of the Government for the purchase of their interests. The Mysore Government, while retaining a financial interest in the Company, agreed to waive the right to share in its active management for the period of the War and for a year to two thereafter, in order to facilitate the operation of the factory as a Government concern.

With the cessation of hostilities the factory was returned to the Government of India, and came under the jurisdiction of the Department of Industries and Supplies. As an interim project the company designed and built the prototype of a railway coach of modified aircraft type construction.

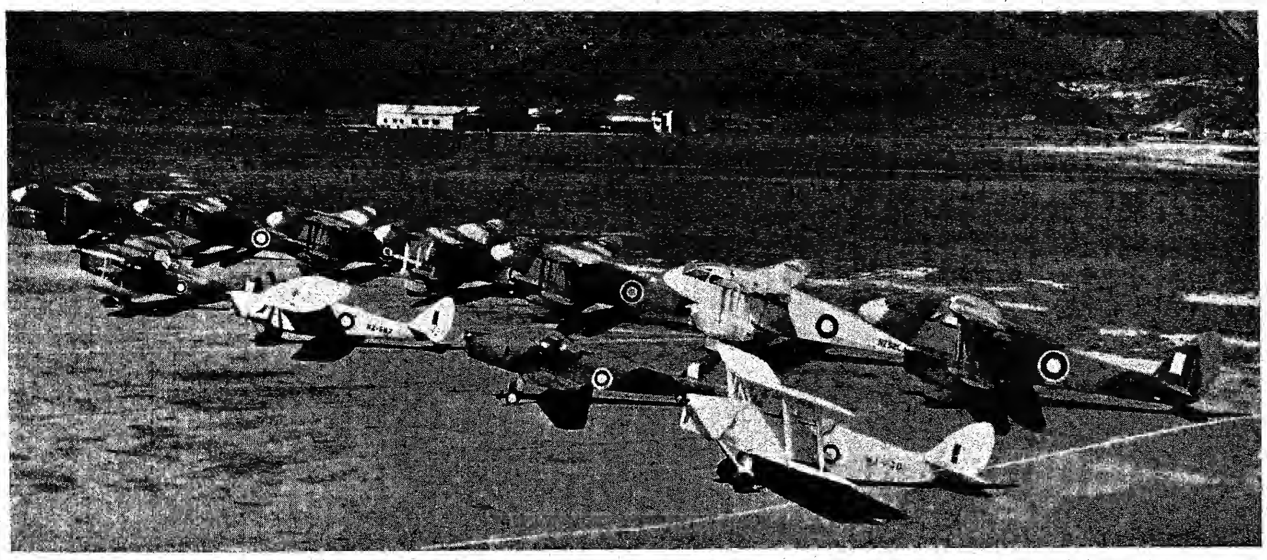
In the meantime a technical mission from the United Kingdom was invited to visit India to advise the Government on the establishment of a national aircraft industry. On the recommendations of this mission, the Central Government have decided to establish such an industry, using the Bangalore factory of Hindustan Aircraft, Ltd. as the nucleus, and plans to attain full self-sufficiency in the manufacture of aircraft needed for the Royal Indian Air Force and Indian Civil aviation in 20 years.

The Central Government proposes to re-constitute the Board of Hindustan Aircraft, Ltd. by the appointment of full-time Managing, Technical and Works Directors from the United Kingdom and a Finance Director from India. Part-time directors will include the Director-General of Civil Aviation a representative of the Department of Industries and Supplies, a nominee of the Mysore Government and two Indian industrialists.

The Government have decided that the design of an original prototype aeroplane suited to Indian conditions should be taken in hand as soon as possible. In order to keep the factory in full employment while the aircraft design organization is being built up, an initial order for fifty Percival Prentice trainers has been given to the company, the first twenty to be assembled from imported components and the remaining thirty to be built at Bangalore.

NEW ZEALAND

DE HAVILLAND.



The de Havilland Factory and Aerodrome at Rongotai, New Zealand. The aircraft are D.H. Dominies, with a Fox Moth, a Puss Moth, a Moth Minor, and a Tiger Moth in the foreground.

THE DE HAVILLAND AIRCRAFT CO. OF NEW ZEALAND, LTD.

Head Office and Works: Rongotai, Wellington.

The New Zealand branch of the de Havilland Aircraft Co., Ltd., was formed early in 1939. An initial order for 100 Tiger Moths was placed with the Company by the New Zealand Government and delivery began in May, 1940.

By the end of the war the New Zealand factory had built 345 Tiger Moths for the Royal New Zealand Air Force. The company also overhauled and rebuilt D.H. aircraft and Gipsy engines, as well as Airspeed Oxford trainers, for which the manufacture of major components was also undertaken. Other types of British and American engines were also overhauled in the Rongotai factory.

Early in the war the company fitted Dragon Rapide and D.H. 86 airliners taken over by the R.N.Z.A.F. from the New Zealand transport companies with bomb-racks for training and anti-submarine work.

CZECHOSLOVAKIA

The Czechoslovak Aircraft Industry, which was established in 1918-1920, reached a high technical standard between the two World Wars and its production capacity was quite considerable. It was able to meet the requirements of the Czechoslovak Air Force and civil aviation, including flying clubs and private owners, and, furthermore, exported aircraft and aero-engines to almost every country in the World.

Czechoslovak aircraft and engines were also manufactured under licence in other countries, and they gained numerous international records in sporting and racing events.

During the 1939-45 War the aircraft industry was forcibly incorporated in the German war-production programme. It was completely disorganised and its former structure basically changed. As all commercial relationships were broken off and their machinery and equipment reduced, development of new designs was not possible.

After the liberation, therefore, it was necessary to rebuild the entire industry with a complete reorganisation, and it has been remodelled on a national economic basis. Nearly all factories connected with aircraft production were nationalised by Presidential Decree on October 24, 1945, and on March 7th, 1946, the Minister of Industry formed two large National Corporations for the production of aircraft and aero-engines, and one National Corporation for instrument and accessory production.

All of these National Corporations of the aircraft industry, as well as all those of the metal and engineering industry, fall under the following central administration :—

ČS. ZAVODY KOVEDELNE A STROJIRENSKE, NARODNI PODNIK (Czechoslovak Metal-Working and Mechanical Engineering Plants, National Corporation).

Central Direction : Jungmannova 29, Prague.
General Director : Dr. Ing. V. Fabinger.
Vice-General Director and Managing Director (Aircraft Industry) : Ing. J. Novák.

The two National Corporations employed in aircraft and aero-engine production, and the factories they control, are :—

AUTOMOBILOVE ZAVODY, NARODNI PODNIK (Motorcar Works, National Corporation).

Head Office : Mladá Boleslav.
Central Director : Dr. Ing. Alois Hrdlička.
Cakovice Plant : (Formerly the Avia factory,)—Aircraft and engines.
Chocen Plant : (Formerly Ing. J. Mráz,)—Aircraft.
Otrokovice Plant : (Formerly Zlínské Letec .é Závody,)—Aircraft and engines.
Kundvice Plant : (Formerly an Avia branch factory).

LETECKY ZAVODY, NARODNI PODNIK (Aviation Works, National Corporation).

Head Office : Ceskomoravska tr. 346, Prague VIII.
Central Director : Ing. Ferdinand Fichý.
Jinonice Plant : (Formerly A. S. Walter, Tovarny na Automobily a Letecké Motory)—Engines.
Karlín Plant : (Formerly Ceskomoravska-Kolben-Danek—Praga Aviation Department)—Aircraft and engines.
Letnany Plant : (Formerly Rudy Letov)—Aircraft.
Vysočany Plant : (Formerly Aero Tovarna Letadel Dr. Kabes)—Aircraft.

All sales for the National Corporations of the aircraft industry are controlled by :—

ČS. ZAVODY KOVEDELNE A STROJIRENSKE, NARODNI PODNIK, ODD LETECKY PRODEJ (Czechoslovak Metal-Working and Mechanical Engineering Plants, National Corporation, Sales Department of Aviation Products).

Head Office : Prague XVII—Jinonice.
Director : Ing. J. Kurzweil.

Although on a national basis the various aircraft and aero-engine manufacturing corporations retain their original aircraft type names, *e.g.*, Avia, Letov, Praga, Walter, etc., and it is under these headings that details of their products are given in the following pages.

A number of small firms in the aircraft and aero-accessory industry have remained in private hands.

AERO.

LETECKY ZÁVODY, NÁRODNÍ PODNIK, ZAVOD VYSOCANY (Aviation Works, National Corporation). Vysocany Plant.

Head Office and Works : Ul. Julia Fucika 305, Prague IX.

Managing Director : Ing. Alexander Böttner.
Technical Manager : Ing. Bořivoj Břeštovský.

The Aero factory is one of the oldest aircraft manufacturers in Czechoslovakia. It was founded in 1919, and has since produced about forty different types of aircraft for military and civilian purposes. The Aero A.12, A.18, A.42, A.200 and others were successful in various national and international flying contests. Particulars and illustrations of the Aero A.204, A.300 and A.304 twin-engined monoplanes were included in the 1939 Edition of this Annual.

Prior to and during the War the Aero factory was forced to undertake sub-contract production, which necessitated a substantial enlargement of the factory. Types produced under licence included the MB 200, the Russian SB-2, and the German Bücker Bü 131 Jungmann, Focke Wulf Fw 189, Siebel Si 204, and airframes for the Focke Wulf Fw 190.

At the end of the War the factory prepared to resume production of its own designs. It has since been nationalised, and is now engaged in developing new transport and training aircraft and new military types for the Czechoslovak Air Force. Details of the Aero 45 twin-engined cabin monoplane, which was under construction at the time of writing, are given herewith.

THE AERO 45.

Type.—Twin-engined Touring Monoplane.

Wings.—Cantilever low-wing monoplane. All-metal two-spar structure consisting of centre-section integral with fuselage and two tapered outer wings. I-section spars, duralumin ribs and sheet duralumin covering. Statically and dynamically-balanced ailerons have steel-tube frames and fabric covering, and are attached on ball-bearing hinges. Controllable trim-tab in each aileron. Manually-operated split trailing-edge flaps in three sections each side. Wing area 16 sq. m. (172.22 sq. ft.).

Fuselage.—Metal monocoque structure of oval cross-section. Nose section detachable for access to controls.

Tail Unit.—All-metal cantilever monoplane type. Tailplane has two spars and is adjustable on ground about rear spar. Fin integral with fuselage. Fixed surfaces metal-covered. Statically- and dynamically-balanced rudder and elevators have welded steel-tube frames and fabric covering, and are attached on ball-bearing hinges. Controllable trim-tabs in rudders and elevators.

Landing Gear.—Retractable two-wheel type. Main wheels carried on oleo shock-absorber legs retract rearwards into engine nacelles and are enclosed by twin doors. Hydraulic operation. Low-pressure tyres, and mechanically-operated brakes. Track 2.56 m. (8 ft. 4.6 in.). Castering spring tail-skid with oil buffer carries solid rubber tail-wheel and retracts rearwards into fuselage.

Power Plant.—Two 105 h.p. Walter Minor 4-III four-cylinder in-line air-cooled engines flexibly mounted on steel-tube bearers which are attached to wing centre-section at four points. Two-blade airscrews. Fuel capacity 180 litres (39.5 Imp. gallons) in inter-spar duralumin tanks. Aluminium oil-tank behind each engine.

Accommodation.—Enclosed cabin seating pilot (on port) and one passenger side-by-side with dual controls, and two passengers behind on full-width seat. Access door on each side.

Dimensions.—Span 12 m. (49 ft. 4 in.), Length 7.50 m. (24 ft, 7. in.) Height 2.30 m. (7 ft. 6 in.).

Weights and Loadings (Designed).—Weight empty 890 kg. (1,961 lbs.), Crew 300 kg. (661 lbs.), Fuel 130 kg. (287 lbs), Oil 25 kg. (55 lbs.), Luggage 45 kg. (99 lbs.), Weight loaded 1,390 kg. (3,063 lbs.), Wing loading 86.8 kg/sq. m. (17.76 lbs./sq. ft.), Power loading 6.6 kg/h.p. (14.55 lbs./h.p.).

Performance (Estimated).—Maximum speed 280 km.h. (174 m.p.h.) Cruising speed (70% power) 245 km.h. (152 m.p.h.), Climb to 2,000 m. (6,560 ft.) 9½ minutes, Climb to 3,000 m. (9,840 ft.) 17 minutes Service ceiling 4,700 m. (15,415 ft.), Cruising range 1,000 km (621 miles).

AVIA.

AUTOMOBILOVE ZAVODY, NARODNI PODNIK, ZAVOD CAKOVICE (Motorcar Works, National Corporation).—Cakovice Plant.

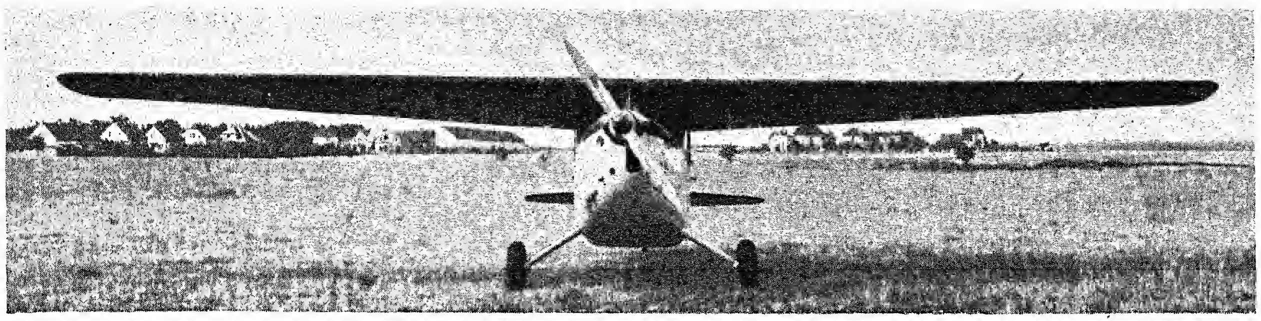
Head Office and Works : Prague, Letňany.

Managing Director : Ing. J. Stěnička.

Chief Designer : Ing. J. Schraml.

This works was founded in 1922 and has occupied a leading position in the Czechoslovak aircraft industry. A wide variety of military, transport and civilian designs was produced, and many of them were successful in international competitions. Notable types included the Avia 534, which became a standard fighter in the military arm, and the Avia 122 aerobatic aircraft. The last type to be completed before the German Occupation was the Avia 35 single-seat fighter monoplane, fitted with a Hispano Suiza 12 Ycrs. engine, which was illustrated in the 1939 Edition of "All the World's Aircraft."

During the Occupation all development work ceased, and the factory was used for war production by the Germans. By



The Avia 36 Two-seat Cabin Monoplane (65 h.p. Walter Mikron 4-III engine).

the Presidential Decree of October 24, 1945, the Avia works was incorporated in the Motor Car Works, National Corporation. Production has now been resumed with the Avia 36 two-seat light monoplane, and other designs are under development.

This works is also engaged in converting Douglas C-47 transport monoplanes for civilian use on the Czechoslovak transport services.

THE AVIA 36.

Type.—Two-seat Cabin Monoplane.

Wings.—Cantilever high-wing monoplane. Wooden two-spar structure with plywood covering. Wooden ailerons with fabric covering, and all-wood trailing-edge flaps between ailerons and fuselage. Wing area 15 sq. m. (161.4 sq. ft.).

Fuselage.—Welded steel-tube structure with fabric covering.

Tail Unit.—Cantilever monoplane type. Wooden structure with ply-covered fin and tailplane, and fabric covering over rudder and elevators.

Landing Gear.—Fixed two-wheel type. Each main wheel carried on single cantilever shock-absorber leg and faired by metal spat. Mechanically-operated brakes. Steerable tail-wheel.

Power Plant.—One Walter Mikron 4-III four-cylinder in-line inverted air-cooled engine rated at 65 h.p. at 2,600 r.p.m. at sea level, and driving Avia two-blade fixed-pitch wooden airscrew. Fuel capacity 45 litres (10 Imp. gallons) ; oil capacity 7.3 litres (1.6 Imp. gallons).

Accommodation.—Enclosed cabin seating two side-by-side with dual controls. Access door on each side.

Dimensions.—Span 10.59 m. (34 ft. 9 in.), Length 7.09 m. (23 ft. 3 in.), Height 1.96 m. (6 ft. 5 in.).

Weights and Loadings.—Weight empty 455 kg. (1,003 lbs.), Disposable load 200 kg. (441 lbs.), Weight loaded 655 kg. (1,444 lbs.), Wing loading 43.64 kg./sq. m. (8.94 lbs./sq. ft.), Power loading 10.18 kg./CV (22.2 lbs./h.p).

Performance.—Maximum speed 180 km.h. (112 m.p.h.) at sea level, Cruising speed 160 km.h. (99 m.p.h.), Landing speed (with flaps) 68 km.h. (42 m.p.h.), Rate of climb at sea level 150 m./min. (492 ft./min.), Ceiling 3,500 m. (11,480 ft.), Cruising range 515 km. (320 miles).

LETOV.

LETECKY ZAVODY, NARODNI PODNIK, ZAVOD LETNANY (Aviation Works, National Corporation—Letnany Plant).

Head Office and Works : Prague, Letňany.

Works Manager : Ing. V. Syrový.

Chief Engineer : Ing. B. Matzner.

This factory was founded in 1918 and is the oldest aircraft manufacturing company in Czechoslovakia. It is also engaged in the production of variable-pitch airscrews.

Just prior to the War the Letov company produced the S-50 twin-engined military monoplane, full details of which were given in the 1939 Edition of "All the World's Aircraft."

The company was nationalised on October 24, 1945, and is now developing the L.101 twin-engined feeder-line monoplane and the L.290 Orel four-engined forty-eight passenger airliner. Particulars of both of these types are given hereafter.

THE LETOV L.101.

Type.—Twin-engined Feeder-line Monoplane.

Wings.—Cantilever low-wing monoplane. All-metal structure consisting of short-span centre-section integral with fuselage and two outer wings bolted on. Constant taper in chord and thickness from roots. Metal ailerons, with split trailing-edge flaps between ailerons and fuselage. Wing area 41.4 sq. m. (445.63 sq. ft.).

Fuselage.—Metal semi-monocoque structure with formed sheet transverse frames, extruded bulb-angle longitudinal stringers and smooth metal sheet covering

Tail Unit.—Cantilever monoplane type of aluminium-alloy construction. Metal-covered fin and tailplane and fabric-covered rudder and elevators. Controllable trim-tabs in rudder and elevators.

Landing Gear.—Retractable two-wheel type. Main wheels retract rearwards into engine nacelles and are partly exposed in fully-retracted position. Tail-wheel retracts into fuselage.

Power Plant.—Two Argus As 410 twelve-cylinder inverted vee air-cooled engines each rated at 465 h.p. at 3,100 r.p.m. at sea level and driving two-blade variable-pitch airscrews. Windmill-type pitch control. Engines quickly detachable and interchangeable left and right. Two main fuel tanks each of 375 litres (82.5 Imp. gallons) and two auxiliary tanks each of 225 litres (49.5 Imp. gallons).

Accommodation.—Crew of two in enclosed cabin in nose. Main cabin has accommodation for twelve passengers. Access door on port side of fuselage at rear of cabin.

Dimensions.—Span 18.14 m. (59 ft. 6 in.), Length 13.43 m. (44 ft.), Height 4.17 m. (13 ft. 8 in.).

Weights and Loadings (Designed).—Weight empty 3,285 kg. (7,240 lbs.), Disposable load 1,965 kg. (4,330 lbs.), Weight loaded 5,250 kg. (11,571 lbs.), Wing loading 127 kg./sq. m. (26 lbs./sq. ft.), Power loading 5.6 kg./h.p. (12.34 lbs./h.p.).

Performance (Estimated).—Maximum speed 320 km.h. (199 m.p.h.), Absolute ceiling 6,000 m. (19,685 ft.).

THE LETOV L.290 OREL.

Type.—Four-engined Airliner.

Wings.—Cantilever low-wing monoplane. Duralumin structure in five main sections consisting of centre-section integral with fuselage, and two inner and two outer sections connected by ball joints. Metal ailerons on outer sections ; plain-hinge trailing-edge flaps, on inner sections. Wing area 206.4 sq. m. (2,221.68 sq. ft.).

Fuselage.—Duralumin semi-monocoque structure, with cross frames, longitudinal stringers and stressed metal skin. Nose and tail sections detachable.

Tail Unit.—Cantilever monoplane type. Duralumin structure consisting of single oleo shock-absorber leg carrying two wheels, which retract into inner engine nacelles. Hydraulic operation. Full-swivelling non-retractable tail-wheel on spring leg. Hydraulic brakes on main wheels.

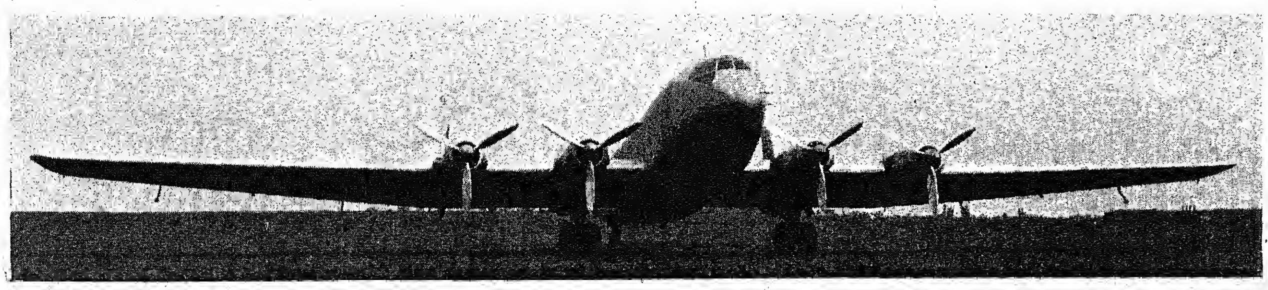
Power Plant.—Four B.M.W. 801 eighteen-cylinder two-row radial air-cooled engines, or other air-cooled or liquid-cooled engines developing a total output of 6,000-8,000 h.p. Engine mountings detachable and interchangeable left and right. Three blade variable-pitch airscrews. Fuel capacity 15,000 litres (3,300 Imp. gallons) in wing tanks.

Accommodation—Crew compartment forward with seats for pilot and co-pilot side-by-side with dual controls. Aft of pilot's seat are positions for navigator, wireless-operator and flight engineer. Baggage room and steward's pantry between crew compartment and main cabin. Main cabin provides accommodation for 44 or 48 passengers in pairs on each side of central aisle. Two toilet compartments, cloakroom and mail compartment aft.

Dimensions.—Span 42 m. (137 ft. 9 in.), Length 28.6 m. (93 ft. 9 in.), Height 6.40 m. (20 ft. 11 in.).

Weights and Loadings (Designed).—Weight empty 23,000 kg. (50,692 lbs.), Crew (six) 460 kg. (1,014 lbs.), Fuel and oil (range 2,300 km. =1,430 miles) 7,540 kg. (16,618 lbs.), Payload (48 passengers) 3,840 kg. (8,463 lbs.), Luggage and mail 3,160 kg. (6,965 lbs.), Weight loaded 38,000 kg. (83,752 lbs.), Wing loading 184 kg./sq. m. (37.68 lbs./sq. ft.), Power loading 5.46 kg./h.p. (12.03 lbs./h.p.).

Performance (Estimated).—Cruising speed 360 km.h. (224 m.p.h.).



The Letov L.290 Orel Airliner (four B.M.W. 801 engines).

MRÁZ.

The Mráz Sokol M.1A Two-seat Cabin Monoplane (105 h.p. Walter Minor 4-III engine).

AUTOMOBILOVE ZAVODY, NARODNI PODNIK, ZAVOD CHOCEN (Motorcar Works, National Corporation—Chocen Plant).

HEAD OFFICE AND WORKS: CHOCEŇ.

Managing Director: Ing. Zdeněk Hlávka.

Chief Designers: Zdeněk Rublič and Ing. Dr. M. Hajn.

This factory was originally formed in March, 1935, under the name of the Ing. P. Beneš & Ing. J. Mráz Tovarna Na Letadla. It produced, among other types, the Beta Minor, Beta Scolar and the Bibi series of monoplanes, details of which were given in the 1939 Edition of this work. Beneš-Mráz designs were victorious in many international flying events before the War.

During the German Occupation development work was interrupted and the factory was engaged in producing the Kranich II sailplane and the Fieseler Fi 156 Storch communications monoplane. The factory is now nationalised, and is equipped with up-to-date machinery.

Details follow of the Mráz Sokol cabin monoplane which is now being produced in two versions, the M.1A two-seater and the M.1C three-seater.

THE MRÁZ SOKOL (FALCON).

TYPE.—Light two/three-seat cabin monoplane.

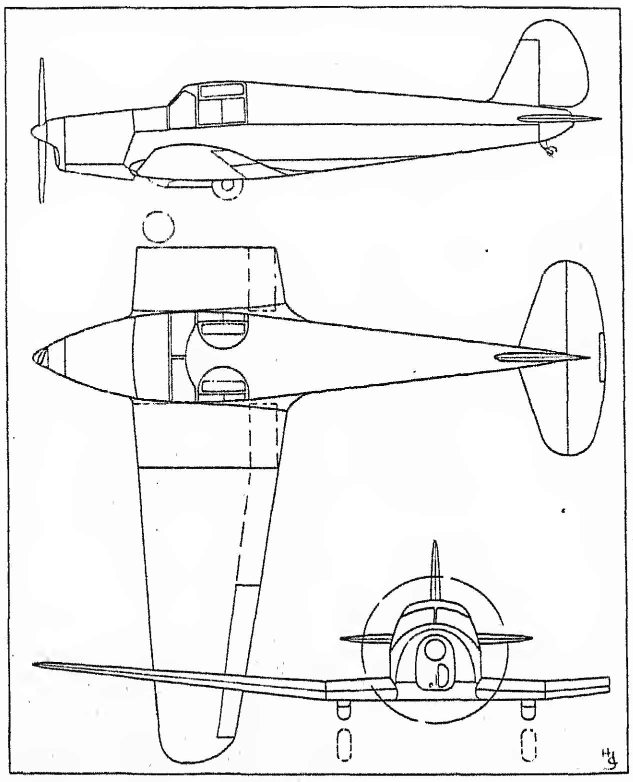
WINGS.—Cantilever low-wing monoplane. Wooden structure in three main sections consisting of centre-section integral with fuselage and two tapered outer sections. Front and rear wooden box-type spars, wooden ribs and plywood covering, over which is a covering of fabric. Diagonal auxiliary spar between main spar in outer wing sections. Wooden ailerons with fabric covering. Split trailing-edge flaps between ailerons and fuselage hinged on rear (auxiliary) spar. Wing area 12 sq. m. (129.17 sq. ft.).

FUSELAGE.—Wooden box-type structure with four main longerons, vertical frames and plywood covering.

TAIL UNIT.—Cantilever monoplane type. Wooden fin and tailplane built integral with fuselage and covered with plywood over which is a covering of fabric. One-piece elevator and horn-balanced rudder of wooden construction with fabric covering. Central trim-tab in elevator.

LANDING GEAR.—Retractable two-wheel type. Main wheels, carried on cantilever half-forks retract backwards into wing, leaving small portions projecting. Mechanical operation by hand-crank. "Window" wheel indicators in wings. Non-retractable self-centring tail-wheel on rubber shock-absorber leg with oil dampening.

POWER PLANT.—One 105 h.p. Walter Minor 4-III four-cylinder in-line inverted air-cooled engine on welded steel mounting, and driving two-blade fixed-pitch wooden or variable-pitch metal airscrew. Duralumin cowling hinged for access. Fuel tank of 50 litres (11 Imp. gallons) capacity in port centre-section, and reserve tank of



The Mráz M.1A Sokol.

The Mráz M.1A Sokol Two-seat Cabin Monoplane (105 h.p. Walter Minor 4-III engine).

MRÁZ.—*continued.*

11 litres (2½ Imp. gallons) capacity in fuselage behind engine bulkhead. Auxiliary 50-litre (11 Imp. gallon) tank can be installed in starboard centre-section.

Accommodation.—Enclosed cabin with two seats side-by-side (M.1 A) with third central seat behind (M.1 C). Dual controls optional. Seats designed for back-type parachutes. Access door on each side hinged on forward cabin frame. Luggage rack aft of seats.

Dimensions.—Span 10 m. (32 ft. 9¾ in.), Length 7.12 m. (23 ft. 4¼ in.), Height (tail up, over cabin) 1.955 m. (6 ft. 5 in.).

Weights and Loadings (M.1 A).—Weight empty (including extra fuel tank and dual controls) 400 kg. (882 lbs.), Pilot and passenger 150 kg. (330 lbs.), Baggage 58 kg. (128 lbs.), Fuel and oil 92 kg. (203 lbs.), Weight loaded 700 kg. (1,543 lbs.), Maximum weight loaded 750 kg. (1,653 lbs.), Wing loading (at 700 kg.=1,543 lbs.) 58.6 kg./sq. m. (12 lbs./sq. ft.), Power loading 6.65 kg./h.p. (14.7 lbs./h.p.).

Weights and Loadings (M.1 C).—Weight empty (including extra fuel tank and dual controls) 407 kg. (897 lbs.), Pilot and two passengers 225 kg. (496 lbs.), Baggage 26 kg. (57 lbs.), Fuel and oil 92 kg. (203 lbs.), Maximum weight loaded 750 kg. (1,653 lbs.), Wing loading (at 750 kg.=1,653 lbs.) 62.5 kg./sq. m. (12.8 lbs./sq. ft.), Power loading 7.25 kg./h.p. (16 lbs./h.p.).

Performance (M.1 A).—Maximum speed 243 km.h. (151 m.p.h.), Cruising speed (65% power) 214 km.h. (133 m.p.h.), Minimum speed with flaps lowered 62 km.h. (38.5 m.p.h.), Initial rate of climb 250 m./min. (820 ft./min.), Absolute ceiling 5,395 m. (17,700 m.), Cruising range, with maximum fuel 1,000 km. (620 miles), Normal range 570 km. (355 miles), Take-off run, with flaps, 140 m. (153 yds.). Landing run with flaps and brakes 90 m. (98 yds.), Fuel consumption 23.8 litres (5.25 Imp. gallons) per hr.

Performance (M.1 C).—Maximum speed 240 km.h. (149 m.p.h.), Cruising speed (65% power) 211 km.h. (131 m.p.h.), Minimum speed with flaps lowered 68 km.h. (42 m.p.h.), Initial rate of climb 244 m./min. (800 ft./min.), Absolute ceiling 4,880 m. (16,000 ft.), Cruising range, with maximum fuel 1,000 km. (620 miles), Normal range 570 km. (355 miles), Take-off run, with flaps 190 m. (207 yds.), Landing run with brakes and flaps 110 m. (120 yds.), Fuel consumption 24.4 litres (5.37 Imp. gallons) per hr.

PRAGA.

LETECKY ZAVODY, NARODNI PODNIK, ZAVOD KARLIN (Aviation Works, National Corporation—Karlin Plant).

Head Office and Works: Prague X, Karlin.

Director: Ing. R. V. Stolle.

Chief Designer: Ing. J. Šlechta.

Praga started manufacturing aircraft in April, 1931, and subsequently produced the well-known Praga E.114 Air Baby, which, with improvements, is still being manufactured. Praga also constructed the E.210 light twin-engined pusher monoplane, and their latest design is the E.117 two-seat monoplane. All of these types are described herewith.

THE PRAGA E.114.

Type.—Two-seat Cabin Monoplane.

Wings.—Cantilever high-wing monoplane. Wooden two-spar structure in one piece attached to fuselage by four bolts. Wing detachable by two men in five minutes. Spar webs and ribs of plywood with pine flanges. Plywood covering and no internal bracing. Ailerons of wooden framework and covering. Wing area 15.2 sq. m. (163.6 sq. ft.).

Fuselage.—Box structure of hexagonal cross-section. Pine framework and plywood covering.

Tail Unit.—Cantilever monoplane type, with fin integral with fuselage. Aerodynamically-balanced rudder of wooden construction with plywood covering Tailplane and elevators of welded steel-tube framework and covered with fabric. Elevators balanced by rubber spring connected to control column.

Landing Gear.—Fixed two-wheel divided type. Each main wheel carried on faired V-struts attached to bottom of fuselage. Third leg attached to bottom of fuselage centre-line and linked with piston inside wheel hub, where rubber shock-absorber discs are compressed. Magnesium wheels and low-pressure tyres.

Power Plant.—One 40-45 h.p. Praga B.2 two-cylinder or 60-79 h.p. Praga D four-cylinder horizontally-opposed direct-drive air-cooled engine on welded steel-tube mounting and enclosed in two-piece cowling. Two-blade fixed-pitch wooden airscrew. Fuel tank in wing.

Accommodation.—Enclosed cabin seating two side-by-side. Side windows and windscreen integral with wing leading-edge, the whole hinging upwards on front spar for access. Light luggage accommodation aft of seats.

Dimensions.—Span 11 m. (36 ft. 1 in.), Length 6.6 m. (21 ft. 8 in.), Height 2.6 m. (8 ft. 6 in.).

Weights and Loadings (Praga B 2 engine).—Weight empty 290 kg. (639 lbs.), Fuel and oil 28 kg. (62 lbs.), Pilot 80 kg. (176 lbs.), Weight loaded 490 kg. (1,080 lbs.), Wing loading 32.13 kg./sq. m. (6.6 lbs./sq. ft.), Power loading 11.95 kg./h.p. (26.33 lbs./h.p.).

Weights and Loadings (Praga D engine).—Weight empty 325 kg. (716 lbs.), Fuel and oil 45 kg. (99 lbs.), Pilot 80 kg. (176 lbs.), Weight loaded 555 kg. (1,223 lbs.), Wing loading 36.5 kg./sq. m. (7.47 lbs./sq. ft.), Power loading 7.27 kg./h.p. (16 lbs./h.p.).

Performance (Praga B 2 engine).—Maximum speed 150 km.h. (93 m.p.h.), Cruising speed 135 km.h. (84 m.p.h.), Landing speed 60 km.h. (37 m.p.h.), Climb to 1,000 m. (3,280 ft.) 10 minutes 47 seconds, Service ceiling 3,500 m. (11,480 ft.), Range 450 km. (280 miles), Take-off run 140 m. (153 yds.), Landing run 120 m. (131 yds.).

Performance (Praga D engine).—Maximum speed 185 km.h. (115 m.p.h.), Cruising speed 160 km.h. (99 m.p.h.), Landing speed 70 km.h. (43 m.p.h.), Climb to 1,000 m. (3,280 ft.) 6 minutes 40 seconds, Service ceiling 4,100 m. (13,450 ft.), Range 500 km. (311 miles), Take-off run 120 m. (131 yds.), Landing run 150 m. (164 yds.).

THE PRAGA E.117.

Type.—Two-seat Cabin Monoplane.

Wings.—Cantilever high-wing monoplane. Wooden two-spar structure in one piece attached to fuselage by four bolts and detachable by two men in five minutes. Spar webs and ribs of plywood with pine flanges. Plywood covering. Steel-tube ailerons with fabric covering. Fabric-covered welded steel-tube trailing-edge flaps between ailerons and fuselage; manual operation. Wing area 14.75 sq. m. (158.77 sq. ft.).

Fuselage.—Welded steel-tube structure with light metal sheet covering forward and fabric-covered aft.

Tail Unit.—Braced monoplane type. Fin and elevators of welded steel-tube framework and fabric covering; tailplane and rudder of wooden construction with fabric-covering. Wire-bracing between fin and tailplane; tailplane strut-braced to fuselage.

Landing Gear.—Fixed two-wheel divided type. Each wheel carried on faired steel-tube leg, wire-braced to fuselage centre-line, with oleo-pneumatic shock-absorber system within fuselage. Wheel brakes. Tail-wheel carried on rubber shock-absorber leg.

Power Plant.—One 60-79 h.p. Praga D four-cylinder horizontally-opposed direct-drive air-cooled engine on welded steel-tube mounting and enclosed by two-piece cowling. Other air-cooled engines of similar power, weight and size may be fitted. Two-blade fixed-pitch wooden airscrew. Fuel tank in wing.

Accommodation.—Enclosed cabin seating two side-by-side with dual controls. Access door on each side.

Dimensions.—Span 10.80 m. (35 ft. 5 in.), Length 6.80 m. (22 ft. 4 in.), Height 2.40 m. (7 ft. 10 in.).

Weights and Loadings.—Weight empty (equipped) 400 kg. (882 lbs.), Fuel and oil 45 kg. (99 lbs.), Pilot 80 kg. (176 lbs.), Payload 110 kg. (242 lbs.), Weight loaded 635 kg. (1,399 lbs.), Wing loading 43 kg./sq. m. (8.8 lbs./sq. ft.), Power loading 8 kg./h.p. (17.64 lbs./h.p.).

Performance.—Maximum speed 215 km.h. (133.5 m.p.h.), Cruising speed 190 km.h. (118 m.p.h.), Landing speed 70 km.h. (43 m.p.h.) Climb to 1,000 m. (3,280 ft.) 7 minutes 20 seconds, Service ceiling 3,500 m. (11,480 ft.), Range 570 km. (354 miles).

THE PRAGA E.210.

Type.—Twin-engined four-seat pusher Monoplane.

Wings.—Cantilever high-wing monoplane. Wooden two-spar structure in one piece, with plywood covering. Welded steel-tube slotted ailerons with fabric covering. Wing area 20.70 sq. m. (222.81 sq. ft.).

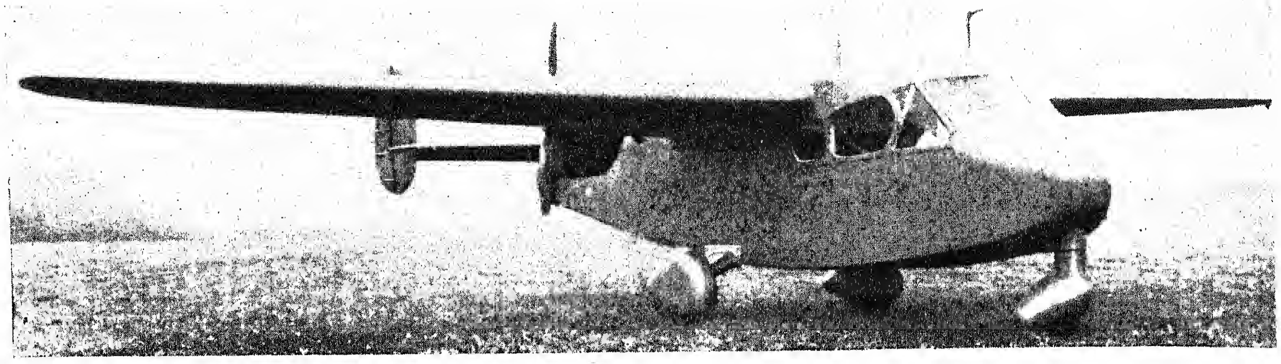
Fuselage.—Welded steel-tube structure of rectangular cross-section. Nose and cabin portion covered with plywood and remainder with fabric.

Tail Unit.—Monoplane type with twin fins and rudders mounted as endplates. Tailplane and fins of wooden construction with plywood covering. Wooden-framed rudders with fabric covering. Elevators have welded steel-tube frames and fabric covering. Trim-tab in each elevator.

Landing Gear.—Fixed tricycle type. Each main wheel carried on single cantilever leg with oleo pneumatic shock-absorber unit

The Praga E.117 Two-seat Cabin Monoplane (60-79 Praga D engine).

PRAGA—*continued.*



The Praga E.210 Four-seat Pusher Monoplane (two 105 h.p. Walter Minor 4-III engines).

within fuselage. Swivelling and self-centring nose-wheel. Brakes on main wheels.

POWER PLANT.—Two 105 h.p. Walter Minor 4-III four-cylinder in-line inverted air-cooled, or two 150 h.p. Praga E eight-cylinder horizontally-opposed air-cooled engines mounted as pusher units on welded steel-tube bearers cantilevered from rear spar. Other engines of similar type may be fitted. Two-blade fixed-pitch wooden propellers. Main and auxiliary fuel tanks in wing centre-section. Oil tanks in engine nacelles.

ACCOMMODATION.—Enclosed cabin seating four in two pairs with dual controls in front. Access door on each side. Baggage compartment aft of rear seats.

DIMENSIONS.—Span 12.50 m. (41 ft. 0 in.), Length 8.42 m. (27 ft. 7 in.), Height 2.34 m. (7 ft. 8 in.).

WEIGHTS AND LOADINGS.—Weight empty 990 kg. (2,182 lbs.), Weight loaded 1,350 kg. (2,975 lbs.), Wing loading 60.3 kg./sq. m. (12.35 lbs./sq. ft.), Power loading (Walter Minor engines) 6.6 kg./h.p. (14.55 lbs./h.p.).

PERFORMANCE (Walter Minor engines).—Maximum speed 230 km.h. (143 m.p.h.), Cruising speed 200 km.h. (124 m.p.h.), Landing speed 85 km.h. (53 m.p.h.), Climb to 1,000 m. (3,280 ft.) 6½ minutes, Service ceiling 4,500 m. (14,760 ft.), One-engine service ceiling 1,000 m. (3,280 ft.), Cruising range 570-800 km. (354-497 miles).

ZLIN.

The Zlin 22 Two-seat Cabin Monoplane (70 h.p. Persy III engine).

AUTOMOBILOVE ZAVODY, NARODNI PODNIK, ZAVOD OTROKOVICE (Motorcar Works, National Corporation—Otrokovice Plant).

HEAD OFFICE: ZLIN.

Managing Director: Ing. Šmela.

Chief Engineer: Ing. Tomáš.

The Zlínské Letecké Závody was founded in 1934 by the well-known shoe manufacturing company, Bata, and prior to the War produced the popular low-priced Zlín XII and 212 single-engined two-seat monoplanes. The Zlín 212 was described and illustrated in the 1939 Edition of this Annual.

The Company was nationalised on October 24, 1945, and is now producing a number of light personal aircraft and gliders which were designed during the German Occupation. Particulars of these aircraft are given hereafter.

THE ZLIN 22.

TYPE.—Two-seat Cabin Monoplane.

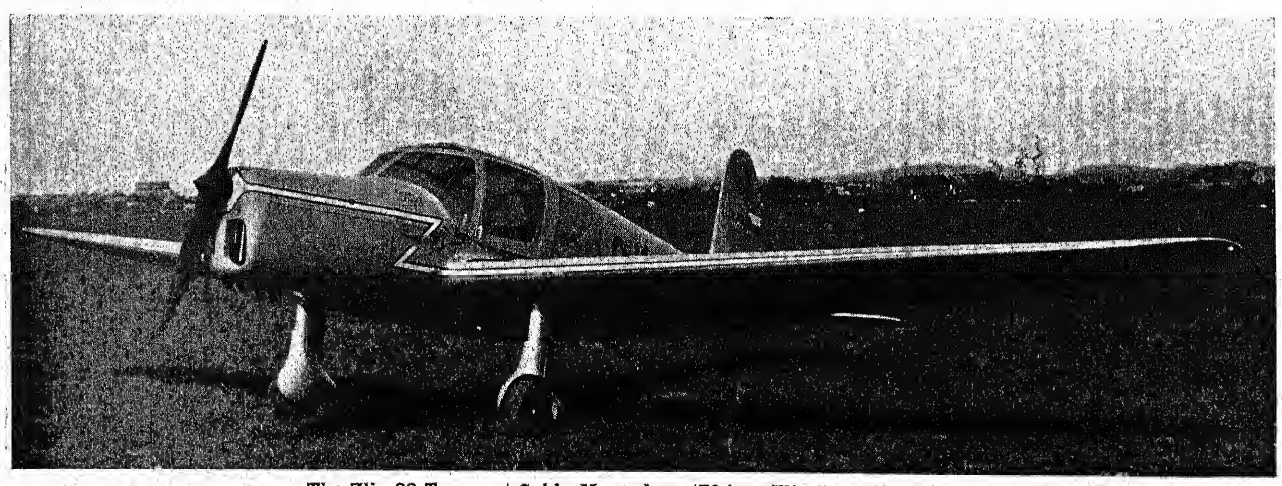
WINGS.—Cantilever low-wing monoplane. Wooden two-spar structure consisting of centre-section and two outer wings. Leading edge covered with plywood and rest with fabric. Wing area 14.65 sq. m. (157.7 sq. ft.).

FUSELAGE.—Wooden monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Wooden structure with ply-covered fin and tailplane and fabric covering to rudder and elevators.

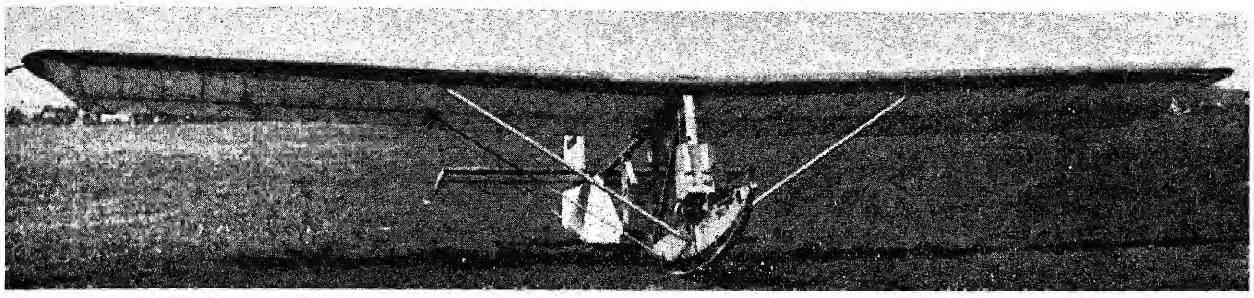
LANDING GEAR.—Fixed two-wheel type. Main wheels carried on oleo-pneumatic shock-absorber legs attached to front spar. Tail-skid.

POWER PLANT.—One 70 h.p. Persy III four-cylinder horizontally-opposed air-cooled engine driving two-blade fixed-pitch wooden airscrew.



The Zlin 22 Two-seat Cabin Monoplane (70 h.p. Zlin Persy III engine).

***ZLIN**—continued.*



The Zlin 23 Honza Elementary Glider.

ACCOMMODATION.—Enclosed cabin with accommodation for pilot and passenger side-by-side.

DIMENSIONS.—Span 10.60 m. (34 ft. 9 in.) Length 7.40 m. (24 ft. 3 in.), Height 1.96 m. (6 ft. 5 in.).

WEIGHTS AND LOADINGS.—Weight empty 370 kg. (815.5 lbs.), Disposable load 230 kg. (507 lbs.), Weight loaded 600 kg. (1,322.5 lbs.), Wing loading 40.9 kg./sq. m. (8.37 lbs./sq. ft.), Power loading 8.57 kg./CV (19.2 lbs./h.p.).

PERFORMANCE.—Maximum speed 185 km.h. (115 m.p.h.), Cruising speed 160 kmh. (99 m.p.h.), Service ceiling 4,200 m. (13,775 ft.), Cruising range 700 km. (435 miles).

THE ZLIN 122.

TYPE.—Three/four-seat Cabin Monoplane.

WINGS, FUSELAGE AND TAIL UNIT.—As Zlín 22.

LANDING GEAR—Retractable two-wheel type Main wheels carried on oleo-pneumatic shock-absorber legs retract into wings. Non-retractable steerable tail-skid.

POWER PLANT.—One 106 h.p. Zlín Toma 4 four-cylinder in-line inverted air-cooled engine driving two-blado wooden airscrew.

ACCOMMODATION.—Enclosed cabin seating pilot and one passenger side-by-side in front with one or two passengers behind.

DIMENSIONS.—As Zlín 22.

WEIGHTS AND LOADINGS.—Weight empty 470 kg. (1,036 lbs.), Disposable load 330 kg. (727 lbs.), Weight loaded 800 kg. (1,763 lbs.), Wing loading 54.6 kg./sq. m. (18.55 lbs./sq. ft.), Power loading 7.5 kg./h.p. (16.53 lbs./h.p.).

PERFORMANCE.—Maximum speed 215 km.h. (133.5 m.p.h.), Cruising speed 190 km.h. (118 m.p.h.), Service ceiling 4,400 m. (14,430 ft.), Cruising range 1,000 km. (621 miles).

THE ZLIN 23 HONZA.

TYPE.—Single-seat Primary Training Glider.

WINGS.—Semi-cantilever high-wing monoplane. Two-spar structure in two main sections. Leading-edge to front spar covered with plywood and rest with fabric. Wing area 14.60 sq. m. (157.2 sq. ft.).

FUSELAGE.—Wooden box structure in three main sections screwed together.

TAIL UNIT.—Wooden monoplane structure with fabric covering.

LANDING GEAR.—Single ash skid suspended on two rubber blocks.

ACCOMMODATION.—Open seat ahead of wings.

DIMENSIONS.—Span 10.0 m. (32 ft. 9½ in.), Length 6.37 m. (20 ft. 10 in.), Height 1.55 m. (5 ft. 1 in.).

WEIGHTS AND LOADINGS.—Weight empty 95 kg. (209 lbs.), Disposable load 85 kg. (187 lbs.), Weight loaded 180 kg. (396 lbs.), Wing loading 12.3 kg./sq. m. (2.52 lbs./sq. ft.).

PERFORMANCE.—Gliding ratio 10 : 1, Sinking speed 1.6 m./second (5 ft. 3 in./second), Maximum towing speed 120 km.h. (75 m.p.h.).

THE ZLIN 24 KRAJANEK.

TYPE.—Single-seat Training Sailplane.

WINGS.—Semi-cantilever high-wing monoplane. Single-spar wooden structure with ply-covered leading-edge and rest with fabric. Wing area 13.50 sq. m. (145:3 sq. ft.).

FUSELAGE.—Wooden structure with plywood covering.

TAIL UNIT.—Wooden monoplano structure with ply-covered fixed surfaces and fabric covering to rudder and elevators.

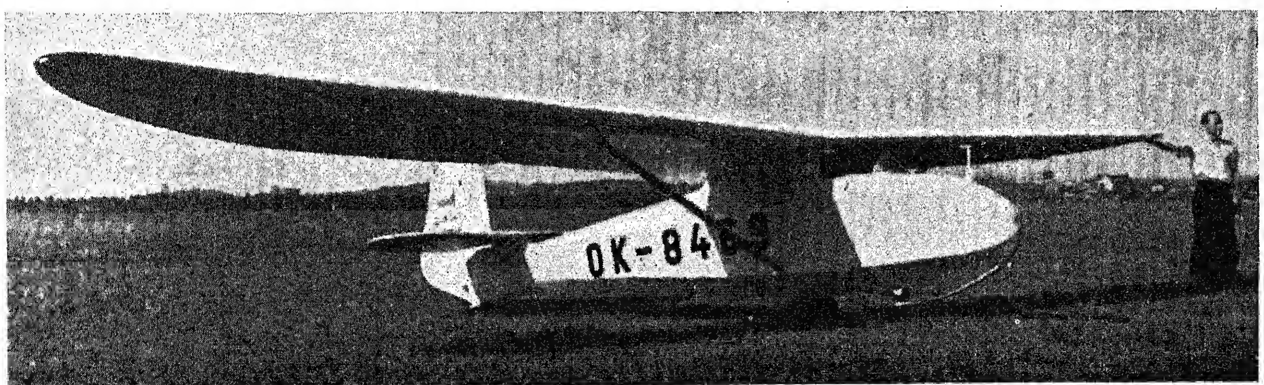
LANDING GEAR.—Single ash skid suspended on rubber blocks.

ACCOMMODATION.—Enclosed cockpit ahoad of leading-edge of wing.

DIMENSIONS.—Span 12.12 m. (39 ft. 9 in.), Length 6.29 m. (20 ft. 7 in.), Height 1.55 m. (5 ft. 1 in.).

WEIGHTS AND LOADINGS.—Weight empty 135 kg. (297.5 lbs.), Disposable load 90 kg. (198 lbs.), Weight loaded 220 kg. (495.5 lbs.), Wing loading 16.29 kg./sq. m. (3.33 lbs./sq. ft.).

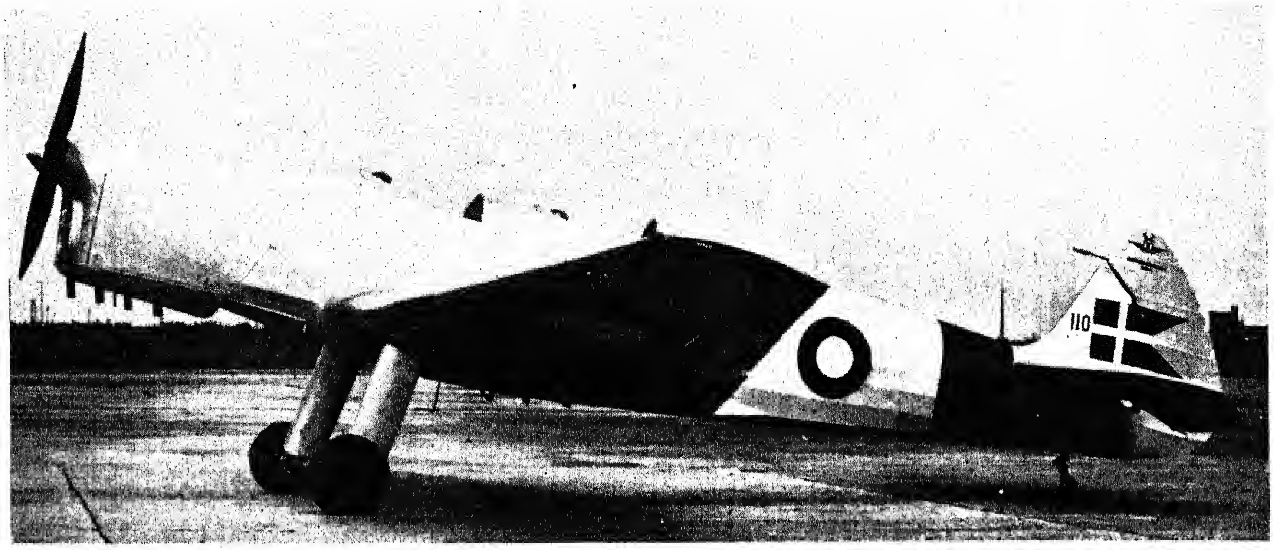
PERFORMANCE.—Gliding ratio 18 : 1 sinking speed 0.8 m./second (2 ft. 7 in./second), Minimum speed 45.4 km.h. (28 m.p.h.), Maximum towing speed 120 km.h. (75 m.p.h.), Maximum diving speed 200 km.h. (124 m.p.h.).



The Zlin 24 Krajanek Training Sailplane.

DENMARK

K.Z.



The KZ II-T Two-seat Trainer (145 h.p. D.H. Gipsy Major I engine) as supplied to the Royal Danish Naval Air Service.

SKANDINAVISK AERO INDUSTRI A/S.

Head Office and Works: Sluseholmen, Sydhaven, Copenhagen.

Repair Shop: Airport of Copenhagen, Kastrup.

Skandinavisk Aero Industri A/s was formed in 1937 to manufacture light aircraft. The Company was financed by a large Danish industrial concern and took over the aircraft manufacturing business formerly conducted by Messrs. Kramme and Zeuthen, who had previously built the KZ I light single-seat monoplane. The pre-war KZ II has been built in three versions, and at the time of writing is in production as a training monoplane, together with the KZ III Lark two-seat and the KZ VII four-seat cabin monoplanes. The KZ IV twin-engined ambulance or light transport monoplane has been built only in small numbers.

THE KZ II-T.

The KZ II-T is a development of the KZ II Sport and the KZ II Kupe monoplanes, details of which were given in the 1939 edition of this Annual. The new aircraft is built specifically for training purposes and conforms to the requirements of A.P. 1208. A series of the KZ II-T has been built to the order of the Royal Danish Naval Air Service.

Type.—Two-seat Trainer.

Wings.—Cantilever low-wing monoplane. Two-spar wooden structure consisting of centre-section let into fuselage and two outer sections. Built-up spruce and plywood spars, and plywood and fabric covering. All wooden members glued with Kaurite. Dihedral 6½ degrees, Root chord 1.9 m. (5 ft. 2½ in.), Wing area 15 sq. m. (161.5 sq. ft.). Single-spar Frise-type ailerons with plywood and fabric covering. Each aileron hinged on three ball-bearings. Aileron area (each) 1.65 sq. m. (17.8 sq. ft.). Split trailing-edge flaps on centre-section with steel-tube frames and fabric covering.

Fuselage.—Welded chrome-molybdenum steel-tube structure with spruce formers and fabric covering. Plywood covering around cockpits.

Tail Unit.—Cantilever monoplane type. Wooden two-spar tailplane and single-spar fin built in one unit, with plywood covering. Dynamically and aerodynamically-balanced rudder has single wooden spar with ply-covered leading-edge and fabric covering aft. Hinged on two ball bearings. Elevators similarly constructed and hinged at five points on ball-bearings. Controllable elevator trim-tab. Tailplane span 3.2 m. (10 ft. 6 in.), Tailplane chord 0.5 m. (1 ft. 7½ in.), Tailplane area 1.6 sq. m. (17.21 sq. ft.), Elevator chord 0.30 m. (11½ in.), Elevator area (total) 0.95 sq. m. (10.2 sq. ft.). Fin area 0.3 sq. m. (3.23 sq. ft.), Rudder area 0.87 sq. m. (9.4 sq. ft.),

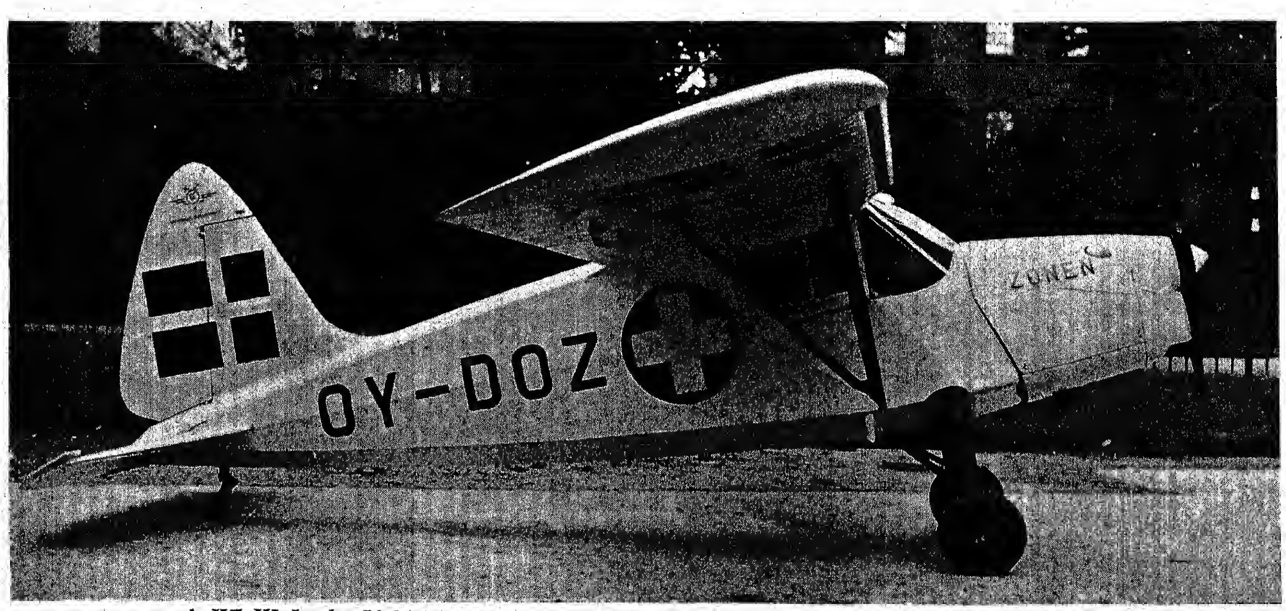
Landing Gear.—Fixed two-wheel type consisting of two cantilever legs with steel-spring and friction-dampening shock-absorbers and low-pressure 465 × 165 wheels. Track 2.0 m. (6 ft. 6½ in.). Full-swivelling solid-tyred tail-wheel mounted on similarly-sprung leg. Ski undercarriage optional.

Power Plant.—One 145 h.p. D.H. Gipsy Major I four-cylinder in-line inverted air-cooled engine mounted on welded steel-tube bearers and driving two-blade wooden airscrew 2 m. (6 ft. 6½ in.) diameter. Two fuel tanks in wing centre-section. Total capacity 110 litres (24.2 Imperial gallons).

Accommodation.—Two open tandem cockpits, with dual controls. Continuous coupé top over cockpit optional. Access door to each cockpit on port side. Seats arranged to take seat-type parachutes. Rear seat has vertical adjustment of 12.7 c/m. (5 in.). Luggage compartment aft of rear cockpit.

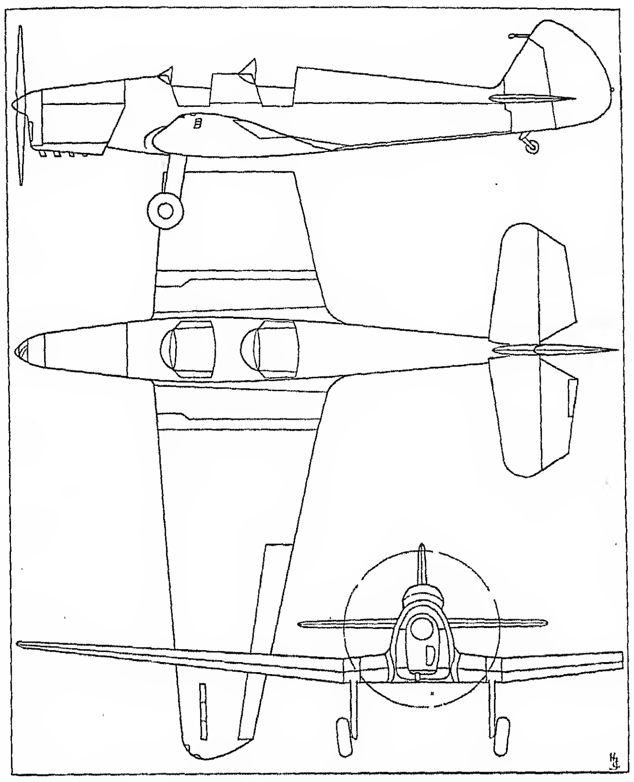
Dimensions.—Span 10.2 m. (33 ft. 6 in.), Length 7.6 m. (25 ft. 0 in.), Height 2.1 m. (6 ft. 10¾ in.).

Weights and Loadings.—Weight empty 550 kg. (1,212 lbs.), Weight loaded (normal) 850 kg. (1,874 lbs.), Weight loaded (aerobatic) 775 lbs. (1,708 kg.). Wing loading (normal) 56.6 kg./sq. m. (11.6 lbs./sq. ft.), Wing loading (aerobatic) 51.6 kg./sq. m. (10.45 lbs./sq. ft.), Power loading (normal) 5.8 kg./h.p. (12.9 lbs./h.p.), Power loading (aerobatic) 5.34 kg./h.p. (11.8 lbs./h.p.).



A KZ III Lærke Light Monoplane supplied to the "Zone-Redningskorp" for Ambulance duties.

***K.Z.**—continued.*



The KZ II-T Trainer.

Performance.—Maximum speed 235 km.h. (146 m.p.h.), Stalling speed 75 km.h. (46.6 m.p.h.), Maximum permissible speed 350 km.h. (218 m.p.h.), Service ceiling 5,000 m. (16,405 ft.), Rate of climb at sea level 270 m./min. (885 ft./min.), Take-off run (fully loaded) 120 m. (131 yds.), Landing run, (fully loaded, with flaps and brakes) 130 m. (142 yds.).

THE KZ III LÆRKE (LARK).

Type.—Two-seat cabin monoplane.

Wings.—Braced high-wing monoplane. Aerofoil section NACA 12023. Wooden structure in two main sections attached to top longerons and braced to lower longerons by steel-tube V-struts on each side. Structure consists of two spruce spars and spruce ribs with ply-covered leading-edge and fabric covering aft. Dihedral 2 degrees. Wing area 13 sq. m. (140 sq. ft.). Slotted ailerons have wooden framework with fabric covering. Ailerons arranged to droop when flaps are lowered. Manually-operated slotted flaps with fabric covering. Built-in fixed slot ahead of front spar running almost complete span.

Fuselage.—Welded steel-tube structure with four main longerons, wooden stringers and fabric covering.

Tail Unit.—Wooden cantilever fin with fabric covering. Horn-balanced and mass-balanced rudder of steel-tube construction with fabric covering. Trim-tab adjustable on ground only. Wooden cantilever tailplane with plywood covering. One-piece elevator has same structure as rudder. Controllable central trim-tab operated by Bowden cable. Tailplane span 3.17 m. (10 ft. 5 in.).

Landing Gear.—Fixed divided type. Consists of two steel-spring shock-absorber legs each braced by V-struts to fuselage centre-line. Low-pressure wheels fitted with 6.00 × 6½ tyres and brakes. Track 2 m. (6 ft. 6½ in.). Full-swivelling tail-wheel on helical-spring shock absorber.

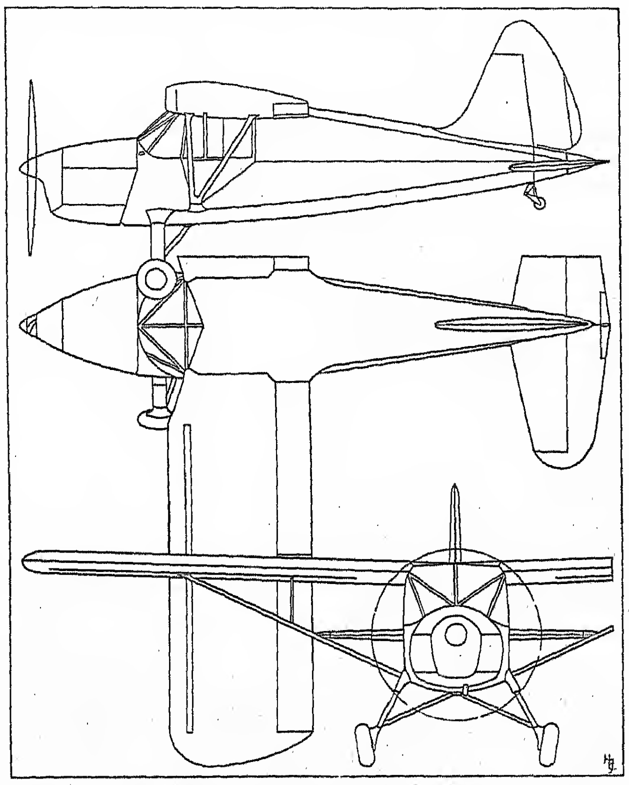
Power Plant.—One 100 h.p. Blackburn Cirrus Minor II four-cylinder in-line inverted air-cooled engine on welded steel-tube mounting and driving Weybridge two-blade fixed-pitch wooden airscrew 1.9 m. (6 ft. 4 in.) diameter. Fuel tank of 68.2 litres (15 Imperial gallons) capacity in fuselage aft of cabin, with provision for 41 litre (9 Imp. gallon) auxiliary tank. Oil capacity 8.2 litres (8.2 Imp. gallons).

Accommodation.—Enclosed cabin seating two side-by-side. Interior width 1.22 m. (4 ft. 0 in.). Dual controls with central Y-type control column. Luggage rack aft of cabin. For use as ambulance right-hand portion of light bulkhead aft of cabin can be removed, and stretcher can be loaded through door on port side of fuselage aft of wings.

Dimensions.—Span 9.6 m. (31 ft. 6 in.), Length 6.6 m. (21 ft. 6 in.), Height (over rudder, tail down) 2.1 m. (6 ft. 11 in.).

Weights and Loadings.—Weight empty 386 kg. (850 lbs.), Fuel and oil 57 kg. (125 lbs.), Pilot and passenger 154 kg. (340 lbs.), Luggage 55 kg. (120 lbs.), Total pay-load 265 kg. (585 lbs.), Loaded weight 651 kg. (1,435 lbs.), Maximum loaded weight (with auxiliary tank and fuel (34 kg.=75 lbs.) and extra 21 kg.=45 lbs. luggage) 706 kg. (1,555 lbs.), Wing loading 48.83 kg./sq. m. (10 lbs./sq. ft.), Power loading 7.25 kg./h.p. (16 lbs./h.p.).

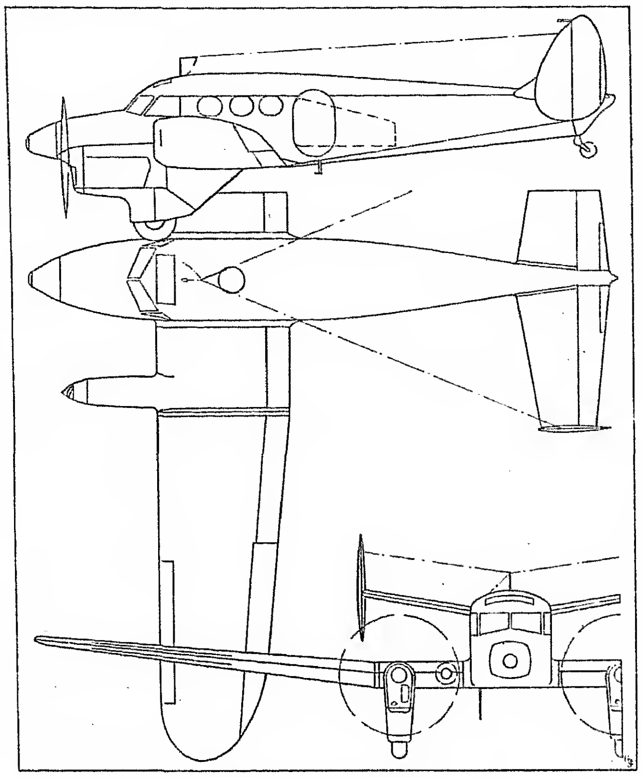
Performance.—Maximum speed 185 km.h. (115 m.p.h.) at sea level' Cruising speed at 2,200 r.p.m. 170 km.h. (106 m.p.h.), Landing speed 55 km.h. (34 m.p.h.), Rate of climb at sea level 213 m./min. (700 ft./min.), Normal range 500 km. (310 miles), Maximum range 805 km. (500 miles), Service ceiling 4,115 m. (13,500 ft.), Rate of glide (flaps up) 1 : 8, Rate of glide (flaps down) 1 : 5, Take-off run 70 m. (77 yds.), Landing run 50 m. (55 yds.).



The KZ III Two-seat Cabin Monoplane.

The KZ IV Ambulance Monoplane (two 130 h.p. D.H. Gipsy Major engines) operated by the "Zone-Redningskorp."

***K.Z.**—continued.*



The KZ IV Ambulance.

THE KZ IV.

The KZ IV was built during the German Occupation of Denmark to the designs of K. G. Zeuthen. It was produced originally to the requirements of the *Zone-Redningskorp*, the Danish First Aid organization, as an ambulance, but it is also convertible to a passenger and cargo aircraft. The KZ IV is not in series production.

Type.—Twin-engined Ambulance.

Wings.—Cantilever low-wing monoplane. Wooden structure with plywood covering in three main sections: centre-section and two outer wings. Fabric-covered wooden ailerons arranged to droop 15 degrees with flaps. Slotted flaps between ailerons and fuselage in two sections each side. Built-in fixed leading-edge slots ahead of ailerons. Gross wing area 30 sq. m. (323 sq. ft.).

Fuselage.—All-wood structure with plywood covering.

Tail Unit.—Twin fins and rudders mounted as endplates to dihedral tailplane. Wooden cantilever structure with plywood covering over fixed surfaces and fabric covering to elevators and rudders. Tailplane span (overall) 5 m. (16 ft. 4¾ in.). Trim-tabs in elevators and rudders.

Landing Gear.—Fixed two-wheel type consisting of two separate units attached at outer ends of centre-section and faired into engine nacelles. Track 3.77 m. (12 ft. 4 in.). Non-retractable tail-wheel.

Power Plant.—Two 130 h.p. D.H. Gipsy Major four-cylinder in-line inverted air-cooled engines driving two-blade fixed-pitch wooden airscrews. Fuel capacity 240 litres (53 Imp. gallons), oil capacity 27.5 litres (6½ Imp. gallons).

Accommodation.—Pilot and co-pilot/radio-operator side-by-side with dual controls. Two stretchers can be carried on starboard side of main cabin, one above the other, with seats for two attendants on port side. Large door on starboard side for loading and unloading stretchers; main entrance door on port side aft of trailing edge. Collapsible table and compact food and medicine cupboards.

Dimensions.—Span 16 m. (52 ft. 6 in.), Length (tail up) 9.8 m. (32 ft. 1 in.), Height (on ground, over cabin) 2.45 m. (8 ft.).

Weights and Loadings.—Weight empty 1,200 kg. (2,645 lbs.), Weight loaded 1,900-2,000 kg. (4,189-4,409 lbs.), Wing loading (at 2,000 kg.=4,409 lbs.) 66.6 kg./sq. m. (13.6 lbs./sq. ft.), Power loading 7.6 kg./h.p. (16.75 lbs./h.p.).

Performance.—Maximum speed 215 km.h. (134 m.p.h.), Cruising speed 200 km.h. (124 m.p.h.), Landing speed 75 km.h. (47 m.p.h.), Maximum range 900 km. (560 miles), Take-off run 140 m. (153 yds.), Landing run 70 m. (77 yds.).

THE KZ VII.

The KZ VII is a four-seat development of the KZ III Lærke previously described in detail and follows the same general shape and constructional methods.

The new aircraft is powered by a 125 h.p. Continental C125 six-cylinder horizontally-opposed air-cooled engine driving a two-blade wooden airscrew, 1.90 m. (6 ft. 3 in.) diameter, and the maximum fuel capacity is 110 litres (24 Imp. gallons). The undercarriage track has been increased to 2.40 m. (7 ft. 10½ in.) and a steerable tail-wheel is fitted.

Dimensions.—Span 9.60 m. (31 ft. 6 in.), Length 6.56 m. (21 ft. 6 in.), Height 2.10 m (6 ft. 11 in.), Wing area 13 sq. m. (140 sq. ft.).

Weights and Loadings.—Weight empty 464 kg. (1,022 lbs.), Fuel and oil 89 kg. (196 lbs.), Disposable load 314 kg. (693 lbs.), Weight loaded 867 kg. (1,911 lbs.), Wing loading 66.6 kg./sq. m. (13.5 lbs./sq. ft.), Power loading 6.9 kg./h.p. (15.3 lbs./h.p.).

Performance.—Maximum speed 200 km.h. (124 m.p.h.) at sea level. Cruising speed 175 km.h. (109 m.p.h.), Landing speed 55 km.h. (34 m.p.h.), Initial rate of climb 170 m./min. (590 ft./min.), Service ceiling 4,115 m. (13,500 ft.), Range 725 km. (450 miles).

The KZ.VII Four-seat Cabin Monoplane (125 h.p. Continental C125 engine).

FINLAND

THE STATE AIRCRAFT FACTORY.

VALTION LENTOKONETEHDAS (THE STATE AIRCRAFT FACTORY).

Works: Tampere.

This factory has supplied the Air Force with various types of military aircraft. The Factory-designed Tuisku and Viima II training biplanes and the Pyry advanced training monoplane have been fully illustrated and described in previous issues of this Annual. The last-known original design emanating from the Factory was the Myrsky, a single-seat fighter monoplane fitted with a Pratt & Whitney Twin-Wasp engine, which was designed in 1940.

All reconditioning of aircraft and aero-engines for the Finnish Air Force has been done at the Factory, which also supplied aeroplanes and aero accessories to the Finnish Light Aeroplane Clubs and private owners.

Considerable attention has been devoted to the investigation of the qualities of home produced materials, particularly timber. Finnish pine proved to be eminently suitable for aircraft use, as the result of tests made in the Factory's laboratories show. Finnish bakelite-glued plywood floats have also proved themselves to be strong, light, economical and resistant to deterioration.

Other developments have been the design and production of skis and adjustable airscrews of bakelite-glued plywood.

FRANCE

AÉROCENTRE.

SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU CENTRE. (S.N.C.A.C).

HEAD OFFICE: 12 BIS, AVENUE BOSQUET, PARIS 7E.

WORKS: BILLANCOURT, ISSY-LES-MOULINEAUX (the former Nieuport Aircraft Works—attached to S.N.C.A.C. in June, 1945); BOURGES, CHATEAUROUX (DÉOLS AND ARDENTE WORKS) AND FOURCHAMBAULT.

President and General Director: Marcel Bloch.
Technical Director: Marcel Roca.
Production Director: Roger Polart.

The S.N.C.A.C. originally comprised factories formerly belonging to the Farman and Hanriot companies and was taken over as a Société Nationale in 1937. All of the factories were in the Occupied Zone, and during the War were put into production for Germany. The former Hanriot works was engaged in the production of the Siebel Si 204D twin-engined communications monoplane, and contracts for a further supply of this aircraft, re-designated the N.C. 701, have been given by the French Government. The Si 204D was fully described under "Siebel" (Germany) in the last issue of "All the World's Aircraft." Also in production is a civilian development of this aircraft known as the N.C. 702 Martinet. The Billancourt, Fourchambault and Bourges works are responsible for these contracts, the latter plant producing the fuselage and end-assemblies. The Billancourt plant is also producing Castel-Mauboussin gliders.

The Issy-les-Moulineaux factory is producing on a sub-contract basis wing assemblies for the S.O.90, while the Châteauroux plant is engaged in manufacturing tail-units for the S.E. 161 Languedoc; fuselage and wing assemblies for the S.O. (Bloch) 175 twin-engined torpedo-bomber, and also complete assembly of these latter aircraft.

Other current S.N.C.A.C. designs are the N.C. 830 and 840 Chardoneret three and four-seat cabin monoplanes, and the experimental N.C. 3020 Belphégor monoplane for high-altitude research, which are described hereafter. Also described are the N.C. 211 Cormoran four-engined transport monoplane now under development; the N.C. 2001 four-seat helicopter, and the N.C. 800, 810 and 820 commercial designs.

Further projected developments are the N.C. 260 and 270 jet-propelled commercial aircraft; the N.C. 1070 twin-engined naval fighter and the N.C.-S.E. 582 single-engined naval fighter.

THE N.C. 211 CORMORAN (CORMORANT).

TYPE.—Four-engined Passenger or Freight Transport.

WINGS.—Cantilever shoulder-wing monoplane. Tapered structure in four main sections consisting of two inner sections carrying engine nacelles and two outer wings with rounded tips. Aerodynamically and statically-balanced ailerons in two sections each side with controllable trim-tab in each inner portion. Slotted trailing-edge flaps each in three sections between ailerons and fuselage. Aspect ratio 9.6. Wing area 200 sq. m. (2,152 sq. ft.).

FUSELAGE.—Deep-section structure divided into two decks.

TAIL UNIT.—Cantilever monoplane type. Aerodynamically and statically-balanced control surfaces. Elevators each in two sections with controllable trim-tab in each inner section. Tailplane span 14.5 m. (47 ft. 7 in.).

LANDING GEAR.—Retractable tricycle type. Each main unit consists of twin wheels carried on shock-absorber leg which retracts forward into inner engine nacelle and is fully enclosed. Twin nose-wheels retract into fuselage. Track 7.7 m. (25 ft. 3 in.).

POWER PLANT.—Four Gnôme-Rhône 14R fourteen-cylinder two-row radial air-cooled engines each rated at a normal output of 1,200 h.p.; a cruising output of 800 h.p. and with 1,600 h.p. available for take-off. Airscrews 4.0 m. (13 ft. 1½ in.) diameter. Inner engine centres 7.7 m. (25 ft. 3 in.); inner and outer engine centres 4.3 m. (14 ft. 1¼ in.).

ACCOMMODATION.—Fuselage divided into two decks. Flight compartment forward on upper deck with accommodation for crew of three comprising pilot (on port) and co-pilot/radio-operator side-by-side with dual controls, and flight engineer aft. Main freight hold on lower deck is 18.1 m. long × 2.7 m. wide × 3.1 m. high (59 ft. 4¼ in. × 8 ft. 10 in. × 10 ft. 2 in.) with floor space of 41 sq. m. (441 sq. ft.) and volume of 150 cub. m. (5,297 cub. ft.). Nose section opens for loading; other openings in sides of fuselage. Hold fitted with two electric winches. Cabin on upper deck aft of crew compartment has accommodation for seven passengers. Toilet compartment on port and luggage compartment between crew compartment and passenger cabin. Additional freight compartment aft of passenger cabin between wing spars. 100-passenger version accommodates 87 passengers on lower deck and 13 above. Lower deck accommodation includes 13-passenger saloon in nose. Four toilet compartments and three baggage compartments. 131-passenger version seats 80 passengers on lower deck and 51 on upper deck.

DIMENSIONS.—Span 44 m. (144 ft. 4 in.), Length 30.5 m. (100 ft. 0 in.), Height 10.1 m. (33 ft. 1¾ in.).

WEIGHTS AND LOADINGS (Designed—Freight version).—Weight empty 21,000 kg. (46,297 lbs.), Crew 300 kg. (661 lbs.), Passengers (seven) 700 kg. (1,543 lbs.), Freight 14,800 kg. (32,638 lbs.), Fuel and oil 3,200 kg. (7,055 lbs.), Weight loaded 40,000 kg. (88,194 lbs.), Wing loading 200 kg./sq. m. (41 lbs./sq. ft.), Power loading 6.25 kg./CV (14 lbs./h.p.).

PERFORMANCE.—Maximum speed 400 km.h. (249 m.p.h.) at 3,000 m. (9,840 ft.), Cruising speed 320 km.h. (199 m.p.h.) at 3,000 m. (9,840 ft.), Landing speed 130 km.h. (81 m.p.h.), Ceiling 9,000 m. (29,530 ft.), Range (in 80 km.h. = 50 m.p.h. head-wind, with 15,500 kg. = 34,171 lbs. payload) 1,000 km. (621 miles), Range (in 80 km.h. = 50 m.p.h. head wind, with 12,500 kg. = 27,558 lbs. payload) 2,000 km. (1,243 miles), Take-off distance to 15 m. (50 ft.) 1,300 m. (1,422 yds.).

THE N.C. 271.

The N.C. 271 is a projected single-seat jet-propelled monoplane for research purposes. It is to be a mid-wing monoplane with swept-back wings and tail-unit and will be fitted with two Walter HWK 109-509A jet-units mounted in the wings close to the fuselage. At the time of writing a full-scale mock-up had been completed.

DIMENSIONS.—Span 7.60 m. (24 ft. 11 in.), Length 8.14 m. (26 ft. 8½ in.), Height 2.99 m. (9 ft. 9¾ in.), Wing area 11.44 sq. m. (123 sq. ft.).

WEIGHTS AND LOADING (Designed).—Weight loaded 3,400 kg. (7,496 lbs.), Maximum landing weight 1,240 kg. (2,734 lbs.), Wing loading 297 kg./sq. m. (60.8 lbs./sq. ft.).

PERFORMANCE (Estimated).—Maximum speed 900 km.h. (559 m.p.h.) Landing speed 120 km.h. (75 m.p.h.).

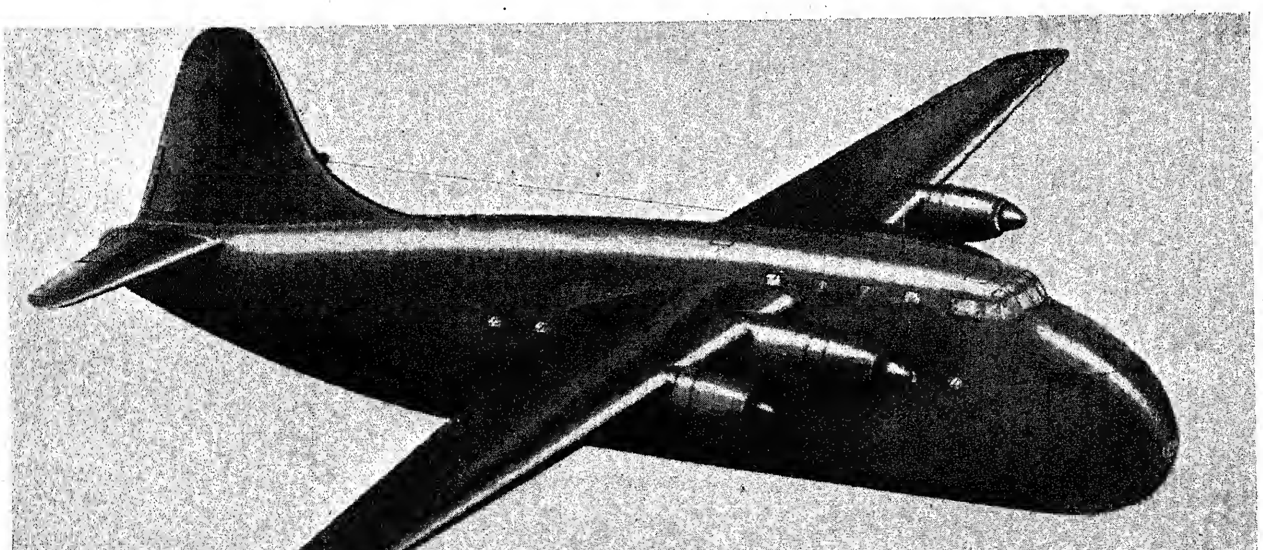
THE N.C. 702 MARTINET (SWIFT).

TYPE.—Twin-engined eight-passenger light Transport.

WINGS.—Cantilever low-wing monoplane. All-metal structure of high aspect ratio constructed in two main sections each attached at four points to fuselage. Single main spar and two false spars ahead of and aft of main spar, chordwise ribs and stressed duralumin skin. Fabric-covered metal ailerons with controllable trim-tab in each. Split trailing edge flaps between ailerons and fuselage in three sections each side. Electro-hydraulic operation. Wing area 46 sq. m. (495 sq. ft.).

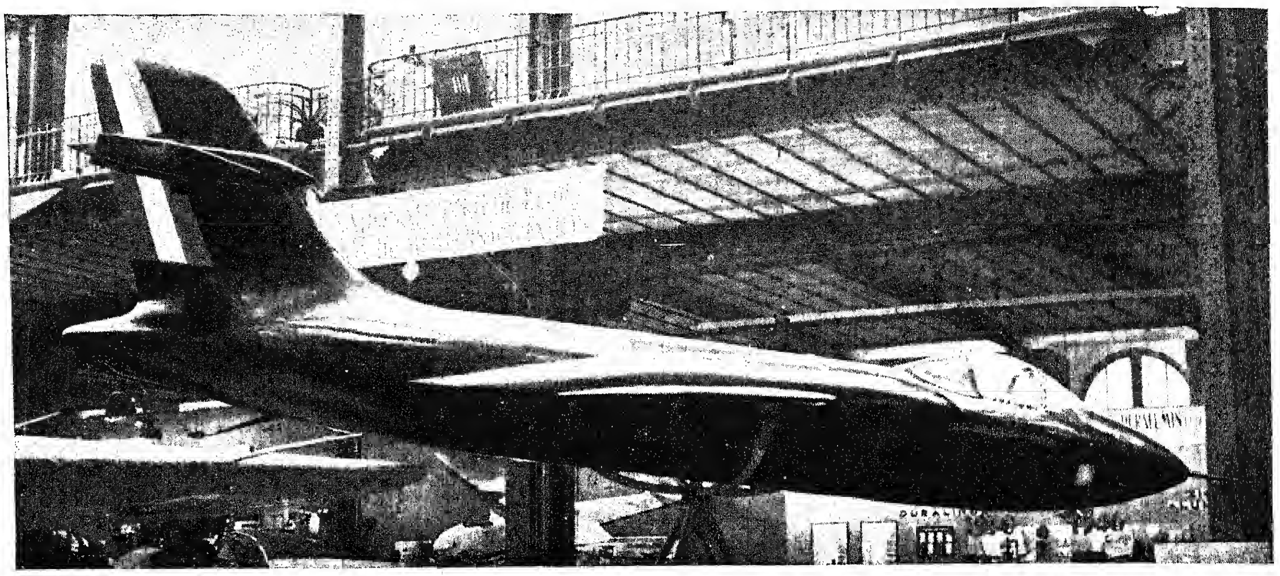
FUSELAGE.—All-metal monocoque structure with vertical frames, longitudinal stringers and stressed sheet duralumin covering.

TAIL UNIT.—Metal cantilever structure, comprising dihedral tailplane and twin fins and rudders mounted as endplates. Metal-covered



A Drawing of the Aérocentre N.C. 211 Cormoran Four-engined Transport Monoplane.

AÉROCENTRE—*continued.*



A mock-up of the Aérocentre N.C. 271 Jet-propelled Research Monoplane.—(*The Aeroplane*).

fins and tailplane; fabric-covered rudders and elevators. Horn-balanced rudder; elevators externally mass-balanced. Electrically-operated trim-tabs in rudder and elevators. Tailplane span 6.2 m. (20 ft. 4 in.).

LANDING GEAR.—Retractable two-wheel type. Main wheels each carried on outside of single shock-absorber leg which retracts rearwards into engine nacelle and is partially enclosed by twin doors. Electro-hydraulic operation. Track 4.404 m. (14 ft. 5½ in.). Non-retractable tail-wheel.

POWER PLANT.—Two Renault 12 S 00 twelve-cylinder inverted vee air-cooled engines each rated at 590 h.p. for take-off; a normal output of 495 h.p. at 2,400 m. (7,875 ft.) and a cruising output of 375 h.p. at 2,000 m. (6,560 ft.). Ratier three-blade controllable-pitch airscrews, 2.65 m. (8 ft. 8¼ in.) diameter. Four fuel tanks in wings with total capacity of 860 litres (189 Imp. gallons). Provision for two 240 litre (53 Imp. gallon) long-range tanks. Two oil tanks in each engine nacelle with total capacity of 120 litres (26.4 Imp. gallons).

ACCOMMODATION.—Crew of two consisting of pilot and co-pilot/radio-operator side-by-side with dual controls. Access door in bulkhead between crew compartment and main cabin. Main cabin is sound-proofed and temperature-controlled and seats eight passengers, four on each side with central aisle. Toilet and luggage compartments aft. Main entry door on port side of fuselage aft of trailing-edge. Freight hold aft, with capacity of 2 cub. m. (71 cub. ft.) and access door on starboard side of fuselage. For freight transport interior equipment is removed and cabin divided into four compartments.

DIMENSIONS.—Span 21.828 m. (71 ft. 7¼ in.), Length 12.81 m. (42 ft.), Height 4.4 m. (14 ft. 5½ in.).

WEIGHTS AND LOADINGS.—Weight empty (equipped) 3,965 kg. (8,741 lbs.), Crew 160 kg. (353 lbs.), Fuel and oil 675 kg. (1,488 lbs.), Disposable load 800 kg. (1,764 lbs.), Weight loaded 5,600 kg. (12,346 lbs.), Wing loading 122 kg./sq. m. (24.7 lbs./sq. ft.), Power loading 6.4 kg./CV (14.3 lbs./h.p.).

PERFORMANCE.—Maximum speed 350 km.h. (217 m.p.h.) at 3,000 m. (9,840 m.), Maximum speed at sea level 315 km.h. (196 m.p.h.), Cruising speed 325 km.h. (202 m.p.h.) at 3,000 m. (9,840 ft.), Cruising speed at sea level 295 km.h. (183 m.p.h.), Landing speed 115 km.h. (71 m.p.h.), Ceiling 7,500 m. (24,605 ft.), One-engine ceiling 3,500 m. (11,480 ft.), Normal range (at 325 km.h. = 202 m.p.h. at 3,000 m. = 9,840 ft.) 810 km. (503 miles) (2½ hrs.), Range with maximum fuel 1,400 km. (870 miles) (4½ hrs.), Maximum range with two 240 litre (53 Imp. gallon) auxiliary fuel tanks 2,000 km. (1,243 miles) (7 hrs.), Take-off run 350 m. (320 yds.).

THE N.C. 800.

The N.C. 800 is a projected twin-engined feeder-line low-wing monoplane with a single fin and rudder and a retractable tricycle landing gear. It is of all-metal construction and is powered by two Renault 6 Q21 six-cylinder in-line air-cooled engines each rated at 240 h.p. at 2,200 m. (7,220 ft.) and with a maximum of 300 h.p. available for take-off. The engines are mounted in the fuselage and coupled together to drive contra-rotating co-axial tractor airscrews in the nose. The fuel capacity is 500 litres (110 Imp. gallons). The crew consists of a pilot and a radio-operator and the cabin seats four passengers.

DIMENSIONS.—Span 12.75 m. (41 ft. 10 in.), Length 9.88 m. (32 ft. 5 in.), Wing area 18 sq. m. (194 sq. ft.), Aspect ratio 9.

WEIGHTS AND LOADINGS.—Weight empty 1,730 kg. (3,814 lbs.), Crew 150 kg. (331 lbs.), Fuel and oil 230 kg. (507 lbs.), Payload 390 kg. (860 lbs.), Weight loaded 2,500 kg. (5,512 lbs.), Maximum overload weight 2,700 kg. (6,173 lbs.), Wing loading (normal) 139 kg./sq. m. (28.4 lbs./sq. ft.), Wing loading (maximum) 150 kg./sq. m. (30.7 lbs./sq. ft.), Power loading (normal) 4.2 kg./h.p. (9.3 lbs./h.p.), Power loading (maximum) 4.5 kg./h.p. (9.9 lbs./h.p.).

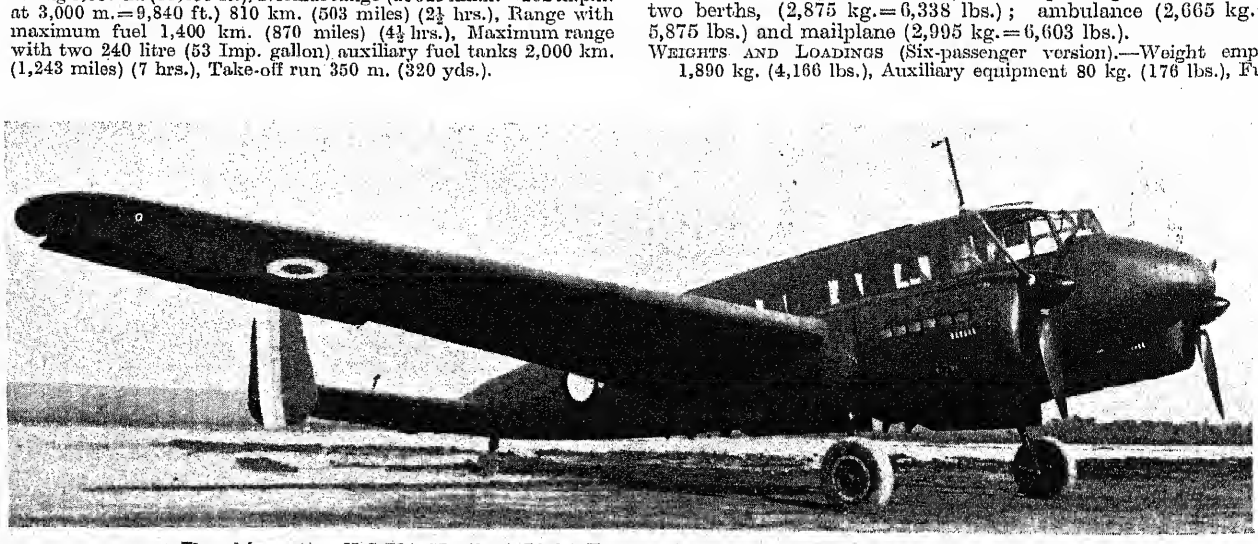
PERFORMANCE.—Maximum speed 415 km.h. (258 m.p.h.), Cruising speed (70% power) 365 km.h. (227 m.p.h.), Landing speed 120 km.h. (75 m.p.h.), Rate of climb 510 m./min. (1,670 ft./min.), Climb to 2,200 m. (7,220 ft.) 4 minutes 18 seconds, Service ceiling 7,900 m. (25,920 ft.), Range (at 2,500 kg. = 5,512 lbs.) 900 km. (560 miles), Range (with maximum fuel) 1,500 km. (930 miles).

PERFORMANCE (On one engine).—Maximum speed 312 km.h. (194 m.p.h.), Cruising speed (70% power) 245 km.h. (152 m.p.h.), Rate of climb 162 m./min. (495 ft./min.), Service ceiling 4,300 m. (14,110 ft.), Range (at 2,500 kg. = 5,512 lbs.) 1,200 km. (750 miles), Range (with maximum fuel) 1,900 km. (1,180 miles).

THE N.C. 810.

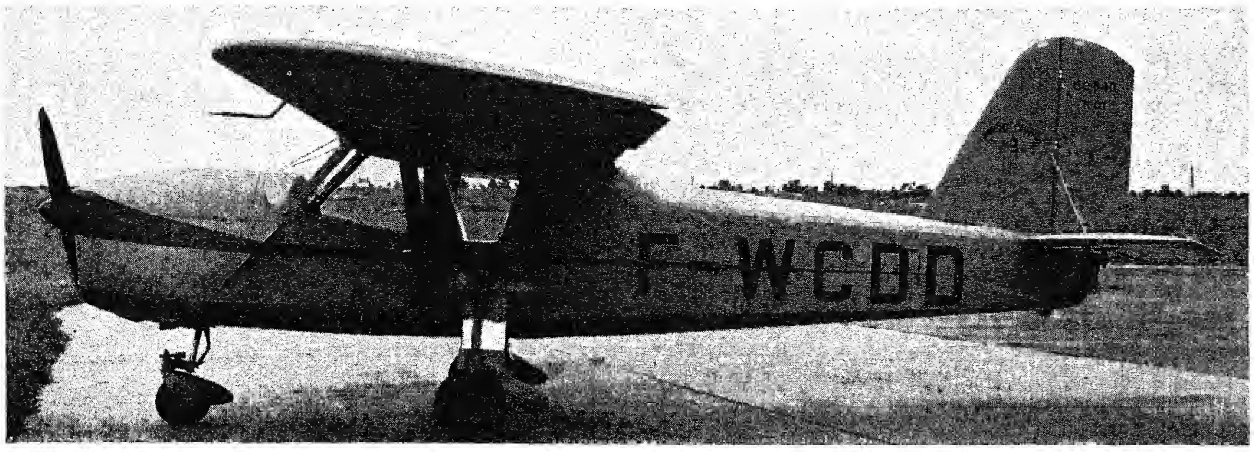
The N.C. 810 is a variation of the N.C. 800 and is identical to it except that it has a longer fuselage incorporating a larger six-passenger cabin and a toilet compartment. It is available in a number of different forms including a six-passenger version, (loaded weight 2,965 kg. = 6,459 lbs.); four-passenger *de Luxe* version, (2,965 kg. = 6,537 lbs.); three-passenger version with two berths, (2,875 kg. = 6,338 lbs.); ambulance (2,665 kg. = 5,875 lbs.) and mailplane (2,995 kg. = 6,603 lbs.).

WEIGHTS AND LOADINGS (Six-passenger version).—Weight empty 1,890 kg. (4,166 lbs.), Auxiliary equipment 80 kg. (176 lbs.), Fuel



The Aérocentre N.C.702 Martinet Light Transport (two 590 h.p. Renault 12 S 00 engines).

***AÉROCENTRE**—continued.*



The Aérocentre N.C. 840 Chardoneret Four-seat Cabin Monoplane (140-152 h.p. Renault 4 POI engine).

and oil 240 kg. (529 lbs.), Crew 150 kg. (331 lbs.), Payload 570 kg. (1,257 lbs.), Weight loaded 2,930 kg. (6,459 lbs.), Wing loading 162 kg./sq. m. (33.2 lbs./sq. ft.), Power loading 4.84 kg./h.p. (10.7 lbs./h.p.).

WEIGHTS AND LOADINGS (Four-passenger *de Luxe* version).—Weight empty 1,890 kg. (4,166 lbs.), Auxiliary equipment 130 kg. (287 lbs.), Fuel and oil 405 kg. (893 lbs.), Crew 150 kg. (331 kg.), Payload 390 kg. (860 lbs.), Weight loaded 2,965 kg. (6,537 lbs.), Wing loading 164 kg./sq. m. (33.6 lbs./sq. ft.), Power loading 4.9 kg./h.p. (10.8 lbs./h.p.).

PERFORMANCE (At 3,000 kg.=6,614 lbs.).—Maximum speed 385 km.h. (240 m.p.h.), Cruising speed (70% power) 330 km.h. (205 m.p.h.), Landing speed 110 km.h. (69.5 m.p.h.), Rate of climb 440 m./min. (1,260 ft./min.), Climb to 2,200 m. (7,220 ft.) 5 minutes 24 seconds, Service ceiling 7,500 m. (24,610 ft.), Range 1,500 km. (930 miles).

PERFORMANCE (On one engine).—Maximum speed 285 km.h. (177 m.p.h.), Cruising speed (70% power) 212 km.h. (132 m.p.h.), Rate of climb 120 m./min. (340 ft./min.), Service ceiling 3,800 m. (12,470 ft.).

THE N.C. 820.

The N.C. 820 is an all-metal low-wing monoplane with twin booms, and is fitted with a retractable tricycle landing gear. It is powered by two 300 h.p. Renault 6Q six-cylinder in-line air-cooled engines mounted in the central nacelle and coupled together to drive contra-rotating co-axial pusher propellers.

It is projected in two versions: a four/five-passenger transport with a crew consisting of pilot and radio-operator, and as a mailplane.

DIMENSIONS.—Span 15 m. (42 ft. 2½ in.), Length 12.85 m. (42 ft. 2 in.), Wing area 32 sq. m. (344 sq. ft.), Aspect ratio 7.

WEIGHTS AND LOADINGS (Four-passenger version).—Weight empty, 2,310 kg. (5,093 lbs.), Crew 150 kg. (331 lbs.), Fuel and oil 230 kg. (507 lbs.), Fuel and oil (with overload) 405 kg. (893 lbs.), Payload 360 kg. (793 lbs.), Weight loaded 3,050 kg. (6,724 lbs.), Maximum overloaded weight 3,225 kg. (7,110 lbs.), Wing loading 95.3 kg./sq. m. (19.5 lbs./sq. ft.), Power loading 5.1 kg./h.p. (11.2 lbs./h.p.).

WEIGHTS AND LOADINGS (Five-passenger version).—Weight empty 2,320 kg. (5,114 lbs.), Crew 150 kg. (331 lbs.), Fuel and oil 320 kg. (705 lbs.), Payload 450 kg. (992 lbs.), Weight loaded 3,240 kg. (7,142 lbs.), Wing loading 101.25 kg./sq. m. (20.3 lbs./sq. ft.), Power loading 5.4 kg./h.p. (11.9 lbs./h.p.).

WEIGHTS AND LOADINGS (Mailplane).—Weight empty 2,170 kg. (4,784 lbs.), Crew 150 kg. (331 lbs.), Fuel and oil 130 kg. (287 lbs.), Fuel and oil (with overload, and normal payload) 320 kg. (705 lbs.), Payload 600 kg. (1,322 lbs.), Payload (with overload and normal fuel) 800 kg. (1,763 lbs.), Weight loaded 3,050 kg. (6,724 lbs.), Maximum overloaded weight 3,240-3,250 kg. (7,142-7,165 lbs.), Wing loading (maximum) 101.5 kg./sq. m. (20.34 lbs./sq. ft.), Power loading (maximum) 5.41 kg./h.p. (11.93 lbs./h.p.).

PERFORMANCE (At 3,050 kg.=6,724 lbs.).—Maximum speed 318 km.h. (198 m.p.h.) at 2,200 m. (7,220 ft.), Cruising speed (70% power) 275 km.h. (171 m.p.h.) at 2,200 m. (7,220 ft.), Landing speed 95 km.h. (59 m.p.h.), Rate of climb 360 m./min. (1,180 ft./min.), Climb to 2,200 m. (7,220 ft.) 6½ minutes, Service ceiling 7,000 m. (22,965 ft.), Take-off distance to 20 m. (66 ft.) 450 m. (492 yds.).

PERFORMANCE (On one engine).—Maximum speed 233 km.h. (145 m.p.h.) at 2,200 m. (7,220 ft.), Cruising speed 157 km.h. (98 m.p.h.) at 2,200 m. (7,220 ft.), Rate of climb 87 m./min. (285 ft./min.), Service ceiling 3,100 m. (10,170 ft.), Take-off distance to 20 m. (66 ft.) 1,050 m. (1,128 yds.).

THE N.C. 840 CHARDONERET (GOLDFINCH).

TYPE.—Four-seat Cabin Monoplane.

WINGS.—Strut-braced high-wing monoplane. All-metal structure in two sections attached to top fuselage longerons and braced to lower longerons by single steel-tube strut on each side. Single-spar structure, with chordwise ribs, thin sheet metal leading-edge and fabric covering aft. Metal-framed fabric-covered ailerons; plain-hinge trailing-edge flaps between ailerons and fuselage. Aspect ratio 6.6. Wing area 19 sq. m. (204.44 sq. ft.).

FUSELAGE.—Welded steel-tube structure with wooden formers and fabric covering.

TAIL UNIT.—All-metal braced monoplane type. Structure consists of steel-tube spars, chordwise ribs and fabric covering over all surfaces. Tailplane braced to fuselage by single steel-tube strut each side. Wire bracing between fin and tailplane. Tailplane span 3.1 m. (10 ft. 2 in.).

LANDING GEAR.—Fixed tricycle type. Main wheels each carried on single cantilever shock-absorber leg attached to sides of fuselage. Steerable nose-wheel in fork on spring leg. Track 1.92 m. (6 ft. 3½ in.). Brakes on main wheels.

POWER PLANT.—One Renault 4 POI four-cylinder in-line inverted air-cooled engine rated at 152 h.p. for take-off, a normal output of 140 h.p. and a cruising output of 100 h.p. Engine mounted on welded steel-tube bearer and driving two-blade airscrew.

ACCOMMODATION.—Enclosed cabin seating four: two side-by-side in front with dual controls, and two aft. Moulded windscreen and roof windows. Access door on each side with sliding windows. Baggage compartment aft of rear seats, with rack for light luggage at top.

DIMENSIONS.—Span 11.20 m. (36 ft. 8½ in.), Length 7.56 m. (24 ft. 9½ in.), Height 2.65 m. (8 ft. 8¼ in.).

WEIGHTS AND LOADINGS.—Weight empty 608 kg. (1,340 lbs.), Fuel and oil 97 kg. (214 lbs.), Passengers 280 kg. (617 lbs.), Baggage 65 kg. (143 lbs.), Weight loaded 1,050 kg. (2,315 lbs.), Wing loading 55 kg./sq. m. (11.26 lbs./sq. ft.), Power loading 6.9 kg./CV (15.4 lbs./h.p.).

PERFORMANCE (At loaded weight of 950 kg.=1,094 lbs.).—Maximum speed 220 km.h. (137 m.p.h.) at sea level, Cruising speed (70% power) 190 km.h. (118 m.p.h.), Landing speed 60 km.h. (37 m.p.h.), Range 700 km. (435 miles), Take-off run 140 m. (153 yds.).

THE N.C. 830.

The N.C. 830 is a variation of the N.C. 840 just described and is a three-seat version equipped with a 90-100 h.p. Régnier 4 EO four-cylinder in-line inverted air-cooled engine. The third occupant sits on a centrally-placed seat aft of the two front seats, and a luggage compartment is provided aft as on the N.C. 840.

DIMENSIONS.—As N.C. 840 except length, 7.71 m. (25 ft. 3½ in.).

WEIGHTS AND LOADINGS.—Weight empty 514 kg. (1,133 lbs.), Fuel and oil 56 kg. (123 lbs.), Passengers 210 kg. (463 lbs.), Baggage 50 kg. (110 lbs.), Weight loaded 830 kg. (1,829 lbs.), Wing loading 44 kg./sq. m. (9 lbs./sq. ft.), Power loading 8.3 kg./CV (18.5 lbs./h.p.).

PERFORMANCE.—Maximum speed 190 km.h. (118 m.p.h.) at sea level, Cruising speed (70% power) 165 km.h. (103 m.p.h.), Landing speed 50 km.h. (31 m.p.h.), Range 500 km. (311 miles), Take-off run 200 m. (219 yds.).

THE N.C. 2001 ABËILLE (BEE).

The N.C. 2001 is a twin-rotor helicopter for commercial uses and is powered by a 450 h.p. Renault 12 S 00 twelve-cylinder vee engine mounted in the fuselage. The two rotors each have two blades, and are contra-rotating and intermeshing. They are metal structures and are carried above the fuselage on two pylons inclined slightly outwards. There is capacity for 550 litres (121 Imp. gallons) fuel.

The fuselage is an all-metal structure with an enclosed cabin forward seating a pilot and co-pilot side-by-side with dual controls, and three passengers aft on a full-width seat. The fuselage terminates in a slender boom at the top which carries the tail-unit with underslung fins and rudders. The tail-unit is a metal cantilever structure with fabric covering.

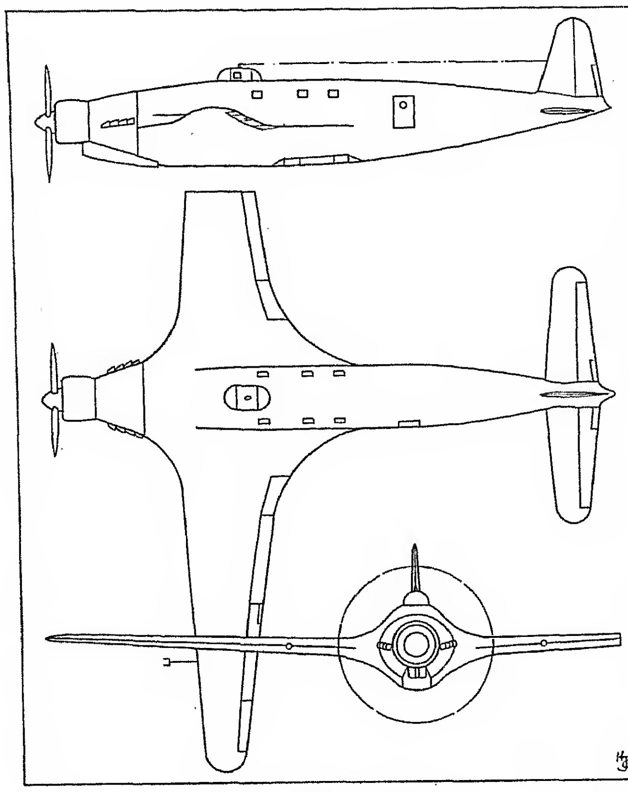
The landing gear is a retractable tricycle, each main wheel being carried on a levered suspension fork mounted on an articulated leg which retracts into the sides of the fuselage and is enclosed by hinged doors. The nose-wheel retracts into the fuselage and is fully enclosed.

DIMENSIONS.—Rotor diameter (each) 13.70 m. (44 ft. 11 in.), Length of fuselage 9.70 m. (31 ft. 10 in.).

WEIGHT LOADED.—2,374 kg. (5,234 lbs.).

PERFORMANCE (Estimated).—Maximum speed 260 km.h. (162 m.p.h.), Cruising speed 200 km.h. (124 m.p.h.), Vertical rate of climb 330 m./ min. (1,083 ft./min.), Ceiling 5,000 m. (16,405 ft.), Still-air range 700 km. (435 miles), Fuel consumption 43 litres (9.46 Imp. gallons) per hour.

AÉROCENTRE—*continued.*



The N.C. 3020 Belphégor.

THE N.C. 2002.

The N.C. 2002 is similar to the N.C. 2001 but is equipped for ambulance duties, and the twin-fin tail-unit is replaced by a single-fin structure.

THE N.C. 3020 BELPHÉGOR.

The N.C. 3020 is a development of the Farman 1000 of 1932, and is an experimental aircraft specially designed for stratospheric research. It was built at the Billancourt works and taken to Toussus-le-Noble for assembly. The first flight was made on June 6, 1946.

TYPE.—Experimental monoplane for stratospheric research.

WINGS.—Cantilever mid-wing monoplane. Composite structure consisting of two half centre-sections and two outer wings. Centre-section increases in chord and depth at a point 3.5 m. (11 ft. 6 in.) from centre-line of fuselage and merges into fuselage. Chord (at 3.5 m. = 11 ft. 6 in. from fuselage centre-line) 2.8 m. (9 ft. 2 in.); thickness/chord ratio 16%. Chord (at 2.2 m. = 7 ft. 2¼ in. from fuselage centre-line) 6.7 m. (22 ft.); thickness (at 2.2 m. = 7 ft. 2¼ in. from fuselage centre-line) 1.45 m. (4 ft. 9 in.); thickness/chord ratio 22%. Structure consists of a main spar, with one auxiliary spar in front and one behind, chordal ribs and longitudinal stringers. Centre-section entirely of metal construction including covering. Outer sections of metal except for front and rear spars, which are of spruce and plywood construction. Metal ailerons in two sections each side with fabric covering. Trim-tab in inner end of each inner section. All-metal trailing-edge flaps in two sections each side. Aspect ratio 10. Gross wing area 50 sq. m. (538 sq. ft.).

FUSELAGE.—Composite structure in three sections: nose-section carrying engine; all-metal centre-fuselage; and wooden rear section. Maximum fuselage depth 2.6 m. (8 ft. 6 in.).

TAIL UNIT.—Cantilever structure with single fin and rudder. Trim-tabs in rudder and elevators.

LANDING GEAR.—Retractable two-wheel type. Each main wheel carried in fork on shock-absorber leg with side link-member hinged at extremity of centre-section retracts inwards into wing between front and main spars and is enclosed by fairing plates attached to leg. Tail-wheel retracts into fuselage and is enclosed by twin doors.

POWER PLANT.—One Daimler-Benz DB.610 engine consisting of two DB.605 twelve-cylinder vee liquid-cooled engines coupled together and developing a maximum output of 3,000 h.p. at 2,800 r.p.m. at sea level, and 1,000 h.p. at 12,000 m. (39,370 ft.). Annular radiator in front of engine. Four-blade airscrew, 4.5 m. (14 ft. 9 in.) diameter.

ACCOMMODATION.—Pressurized accommodation for crew of five consisting of pilot, flight engineer, radio-operator and two research members. Pressure cabin consists of cylinder 1.7 m. diameter × 5.3 m. long (5 ft. 6½ in. × 17 ft. 4½ in.) installed in centre-fuselage; cabin volume 11 cub. m. (388 cub. ft.). Pilot in raised cupola above cabin. Access door at rear of cabin on port side. Observation windows in fuselage under wing trailing-edge.

DIMENSIONS.—Span 22.32 m. (73 ft. 5 in.), Length 17.90 m. (58 ft. 8½ in.).

WEIGHTS AND LOADINGS.—Weight loaded 10,000 kg. (22,046 lbs.), Wing loading 200 kg./sq. m. (40.96 lbs./sq. ft.), Power loading 3.33 kg./CV (7.43 lbs./h.p.).

PERFORMANCE.—Maximum speed 550 km.h. (342 m.p.h.) at 6,000 m. (19,685 ft.), Cruising speed 450 km.h. (280 m.p.h.) at 12,000 m. (39,370 ft.), Rate of climb at sea level (at 2,600 r.p.m.) 600 m./min. (1,968 ft./min.), Climb at 3,000 m. (9,840 ft.) 561 m./min. (1,840 ft./min.), Climb at 6,300 m. (20,670 ft.) 450 m./min. (1,476 ft./min.), Climb to 11,000 m. (36,090 ft.) 38 minutes, Ceiling 12,800 m. (41,995 ft.), Take-off run 430 m. (470 yds.).

THE N.C. A.L.06 FRÉGATE (FRIGATE).

The Frégate is a two-seat twin-boom pusher monoplane powered by a 75 h.p. Régnier 4.J.00 four-cylinder in-line air-cooled engine driving a two-blade propeller. Alternative power plants are the 100 h.p. Régnier 4.K.00 and the 150 h.p. 4.L.00 engines.

The Frégate is a mid-wing monoplane of all-metal construction, with a short ovate monocoque nacelle, and twin booms extending aft from the wing to carry the twin-fin tail-unit. A non-retractable tricycle landing gear equipped with spats is fitted.

The enclosed cabin seats two side-by-side with dual controls.

DIMENSIONS.—Span 10.39 m. (34 ft. 1½ in.), Length 6.50 m. (21 ft. 4 in.), Wing area 13 sq. m. (140 sq. ft.).

WEIGHT AND LOADING.—Weight loaded 650 kg. (1,433 lbs.), Wing loading 50 kg./sq. m. (10 lbs./sq. ft.).

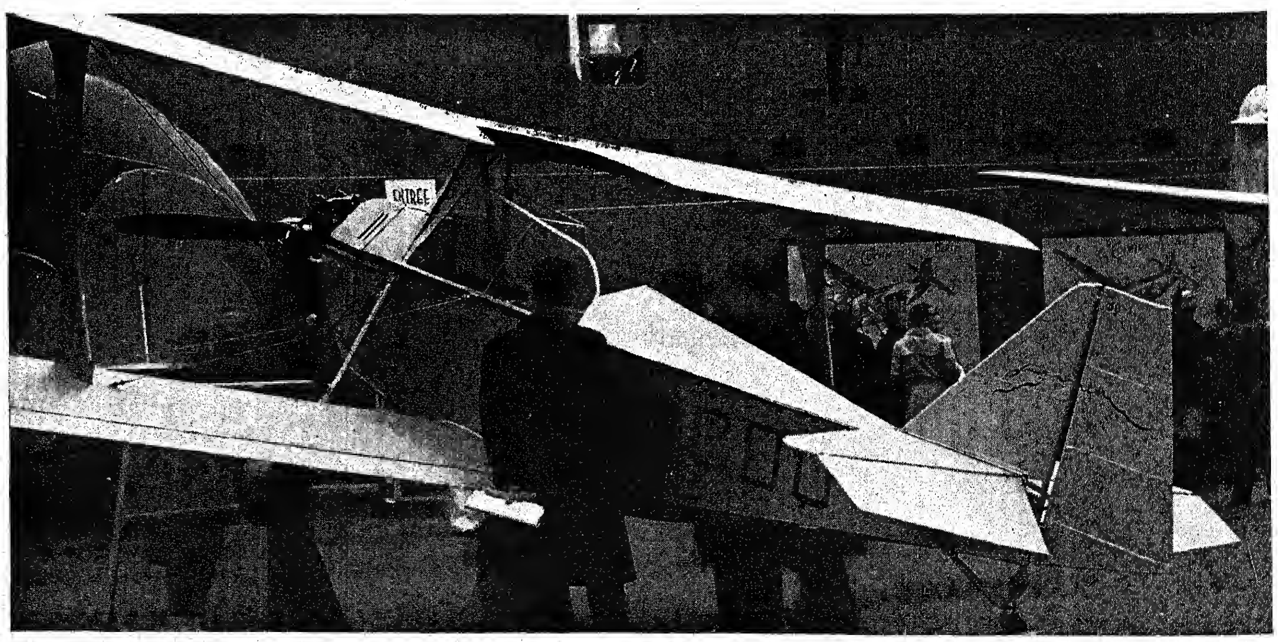
PERFORMANCE (Régnier 4.J.00 engine).—Maximum speed 200 km.h. (124 m.p.h.), Cruising speed 165 km.h. (103 m.p.h.), Range 600-1,500 km. (373-931 miles).

PERFORMANCE (Régnier 4.K.00 engine).—Maximum speed 220 km.h. (136 m.p.h.), Cruising speed 180 km.h. (122 m.p.h.).

PERFORMANCE (Régnier 4.L.00 engine).—Maximum speed 265 km.h. (165 m.p.h.), Cruising speed 225 km.h. (140 m.p.h.).

THE N.C. J.C.1 LÉVRIER (GREYHOUND).

The Lévrier is a two-seat light biplane with twin enclosed cockpits in tandem fitted with dual controls, and is of composite construction.



The Aérocentre N.C. J.C.1 Two-seat Light Biplane (40 h.p. Salmson 9 ADB engine).—(*The Aeroplane*).

AÉROCENTRE—*continued.*

The fuselage is a welded steel-tube structure, with plywood and fabric covering, and the constant-chord single-bay wings are built of wood and fabric-covered. The wings are wire-braced and supported by a single I-interplane strut on each side. Full-span ailerons are fitted to the lower wings. Later aircraft will be fitted with flaps. The monoplane tail-unit has fabric covering over all surfaces, and a fixed two-wheel landing gear is fitted.

The power plant consists of a 40 h.p. Salmson 9 ADR or a 60 h.p. Salmson 9 ADB nine-cylinder radial air-cooled engine driving a two-blade fixed-pitch wooden airscrew.

Dimensions.—Span 7 m. (22 ft. 11 in.), Length 5.31 m. (17 ft. 5 in.), Wing area 13 sq. m. (140 sq. ft.).

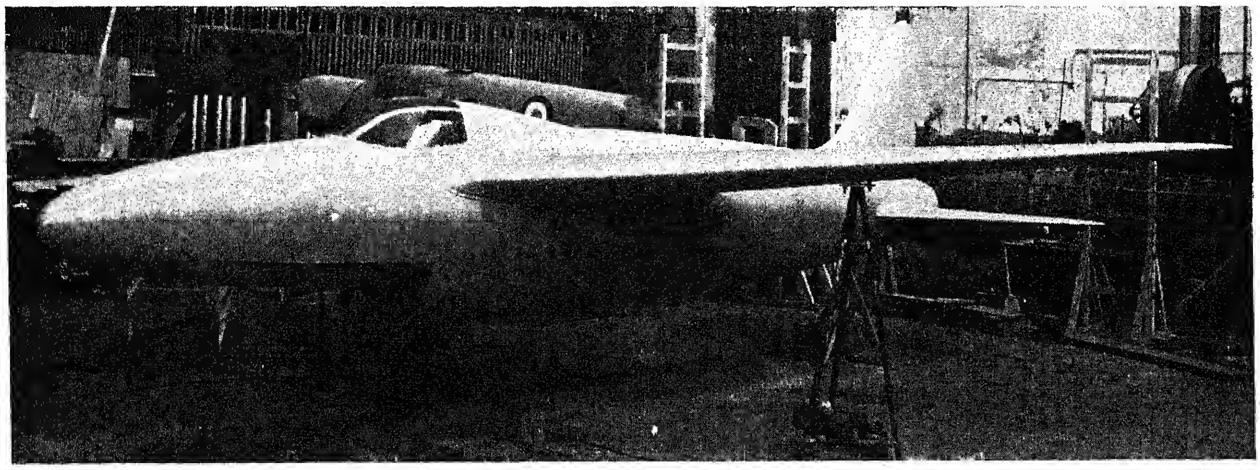
Weights and Loadings (Salmson 9 ADR engine).—Weight empty 190 kg. (419 lbs.), Weight loaded 410 kg. (904 lbs.), Wing loading 31.5 kg./sq. m. (6.45 lbs./sq. ft.), Power loading 11 kg./h.p. (24.2 lbs./h.p.).

Weights and Loadings (Salmson 9 ADB engine).—Weight empty 240 kg. (529 lbs.), Weight loaded 440 kg. (970 lbs.), Wing loading 34 kg./sq. m. (6.96 lbs./sq. ft.), Power loading 7.3 kg./h.p. (16.1 lbs./h.p.).

Performance (Salmson 9 ADR engine).—Maximum speed 154 km.h. (96 m.p.h.), Cruising speed 140 km.h. (87 m.p.h.), Landing speed (with flaps) 40 km.h. (25 m.p.h.), Landing speed (without flaps) 55 km.h. (34 m.p.h.), Range 650 km. (404 miles), Take-off run 100 m. (109 yds.).

Performance (Salmson 9 ADB engine).—Maximum speed 170 km.h. (106 m.p.h.), Cruising speed 160 km.h. (99 m.p.h.), Landing speed (with flaps) 45 km.h. (28 m.p.h.), Landing speed (without flaps) 60 km.h. (37 m.p.h.), Range 350 km. (217 miles), Take-off run 80 m. (87 yds.).

ARSENAL.



The Prototye Arsenal VG 70 Single-seat Jet-propelled Research Monoplane (Junkers Jumo 004B-2 jet unit).

ARSENAL DE L'AÉRONAUTIQUE.

Head Office: 12, Rue Béranger, Chatillon-sous-Bagneux (Seine).

Works: Villeurbanne and Strasbourg.

Technical School: Versailles.

Director: M. Vernisse.

Technical Director: J. Gerardin.

The Arsenal de l'Aéronautique was formed in 1936 under the Law for the Nationalisation of Military Industries, and installed in the Bréguet factory at Villacoublay. Before the outbreak of war in 1939 the Arsenal was engaged in the development of various experimental designs which included the Vernisse-Galtier VG 30 and others.

The VG 30 was later re-designated the VB 10, and development continued throughout the Occupation.

At the time of writing the Factory had completed the prototype of a single-seat jet-propelled fighter known as the VG 70, and test flights were pending. Both the VB 10 and the VG 70 are described hereafter.

The Factory has also designed a number of high-performance sailplanes including the SA.103 Emouchet, the Air 100 and the SA.140. A brief description of the SA.103 is given hereafter.

Details of the aero-engines developed by the Arsenal will be found in Section D.

THE ARSENAL VG 70.

The Arsenal VG 70 is an experimental single-seat jet-propelled monoplane produced for high-speed research purposes. It has a wooden tapered and swept-back wing mounted at the top of the duralumin monocoque fuselage. The wing carries spoilers on upper and lower surfaces and built-in slots fitted to the leading-edge. Trailing-edge flaps are fitted between ailerons and fuselage.

The power plant consists of a Junkers Jumo 004B-2 jet-unit developing a static thrust of 857 kg. (1,890 lbs.). The intake is in a scoop under the fuselage in front of the wing leading-edge and the outlet is in the extreme stern. There is capacity for 700 litres (154 Imp. gallons) fuel.

The tail-unit is a cantilever monoplane structure with swept-back tailplane and elevators. The landing gear is a retractable tricycle, the main wheels retracting into the wing and the nose-wheel into the fuselage.

Dimensions.—Span 8.50 m. (27 ft. 10½ in.), Length 9.70 m. (31 ft. 9¾ in.), Height 2.30 m. (7 ft. 6½ in.), Wing area 15 sq. m. (161.4 sq. ft.).

Weights and Loadings.—Weight loaded 3,000 kg. (6,614 lbs.), Wing loading 200 kg./sq. m. (40.96 lbs./sq. ft.).

Performance (Estimated).—Maximum speed 900 km.h. (559 m.p.h). at 7,000 m. (22,965 ft.), Landing speed 150 km.h. (93 m.p.h.).

THE ARSENAL VB 10.

The VB 10 is a single-seat fighter-bomber of all-metal construction, with a cantilever monoplane tail-unit and a retractable two-wheel landing gear. The wing is a two-spar structure with constant taper in chord and thickness from root. Trailing-edge flaps are fitted in two sections each side between ailerons and fuselage.

The power plant consists of two Hispano-Suiza HS 12Z twelve-cylinder vee liquid-cooled engines each rated at 1,500 h.p. for take-off and developing a normal output of 1,350 h.p. The engines are mounted in tandem in the fuselage and coupled together by a special gear developed by the Arsenal to drive two three-blade contra-rotating co-axial airscrews.

Armament of the VB 10 consists of six 12.7 m/m. (0.5 in.) machine-guns and four 20 m/m. (0.79 in.) cannon mounted in the wings outside the airscrew disc, and provision is made for carrying two 500 kg. (1,102 lbs.) bombs and four rocket projectiles.

Fifty VB 10s have been ordered by the French Government and are to be built by S.N.C.A.N. (Nord).

Dimensions.—Span 15.49 m. (60 ft. 9¾ in.), Length 12.98 m. (42 ft. 7 in.), Wing area 35.5 sq. m. (382 sq. ft.).

Weights and Loadings.—Weight loaded 6,700 kg. (14,771 lbs.), Wing loading 169 kg./sq. m. (34.6 lbs./sq. ft.), Power loading at take-off 2.2 kg./h.p. (4.85 lbs./h.p.).

Performance.—Maximum speed 700 km.h. (435 m.p.h.) at 7,000 m. (22,965 ft.), Ceiling 11,000 m. (36,090 ft.), Normal range 1,700 km. (1,056 miles), Maximum range 2,600 km. (1,616 miles).

THE ARSENAL SA.103 EMOUCHET (KESTREL).

The SA.103 is a single-seat elementary training glider constructed of wood and is in large-scale production for the National Gliding Centres throughout France. It has a high-mounted wing with tapered outer sections, which is braced to the fuselage by a single metal strut on each side. The tail-unit is a cantilever monoplane structure, and the landing gear consists of a single skid under the fuselage.

Dimensions.—Span 12.48 m. (40 ft. 11 in.), Length 6.66 m. (21 ft. 10 in.), Height 1.70 m. (5 ft. 7 in.), Wing area 16.5 sq. m. (177.5 sq. ft.) Aspect ratio 9.5.

Weights and Loadings.—Weight empty 123 kg. (271 lbs.), Weight loaded 218 kg. (480 lbs.), Wing loading 13.2 kg./sq. m. (2.7 lbs./sq. ft.).

Performance.—Maximum towing speed 101 km.h. (63 m.p.h.), sinking speed 0.88 m./second (2.88 ft./second).

AVIANAUTIC.

AVIANAUTIC.

HEAD OFFICE: 217, RUE DIDEROT, VINCENNES (SEINE).

This concern is engaged in the design and manufacture of light sporting aircraft, gliders and sailplanes, canoes, light water craft, etc. Its first powered aircraft is the R.A. 14 two-seat light cabin monoplane described below. Designed by M. Roger Adam and built under the direction of M. René Petitbon, the R.A. 14 made its first flight on March 16, 1946.

THE AVIANAUTIC R.A.14 LOISIRS (LEISURE).

TYPE.—Two-seat enclosed high-wing monoplane.

WINGS.—Strut-braced high-wing monoplane. Two-spar constant-chord structure with semi-circular tips. Solid spruce spars, chordwise ribs and wire-bracing. Leading-edge ply-covered to main spar, fabric-covered aft. Gross wing area 14.60 sq. m. (157.09 sq. ft.). Ailerons have single spruce spars and ribs and fabric covering. Dural-tube V-struts on each side brace wing to lower longerons. Wings fold backwards manually.

FUSELAGE.—Rectangular-section wire-braced structure with four main longerons and transverse frames. Wooden sheet covering forward and fabric aft.

TAIL UNIT.—Semi-cantilever monoplane type. Wooden structure with fabric covering. Tailplane has two solid spruce spars and ribs and is braced to fuselage by steel-tube V-struts. Incidence adjustable on ground. One-piece elevator. Cantilever wooden fin integral with fuselage.

LANDING GEAR.—Fixed divided type consisting of rubber-compression shock-absorber legs attached to upper longerons and braced to lower longerons by radius-rods and half-axles. Medium-pressure wheels. Fixed tail-skid with rubber-compression springing.

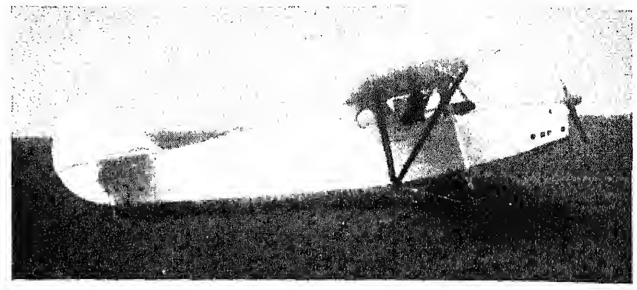
POWER PLANT.—One 40 h.p. Train four-cylinder in-line inverted air cooled engine flexibly mounted on welded steel-tube structure. Two-blade wooden airscrew. Fuel capacity 65 litres (14 Imp. gallons). Oil-tank on engine mounting.

ACCOMMODATION.—Enclosed cabin seating two side-by-side. Adjustable seats. Access door on each side. Baggage compartment aft of seats.

DIMENSIONS.—Span 10.9 m. (35 ft. 8½ in.), Length 7 m. (23 ft. 0 in.).

WEIGHTS AND LOADINGS.—Weight empty 260 kg. (573 lbs.), Disposable load 200 kg. (441 lbs.), Weight loaded 460 kg. (1,014 lbs.). Wing loading 32 kg./sq. m. (6.5 lbs./sq. ft.), Power loading 10.5 kg./h.p (23.15 lbs./h.p.).

PERFORMANCE.—Maximum speed 140 km.h. (87 m.p.h.), Ceiling 5,000 m. (16,400 ft.). Radius of action 500 km. (311 miles). With 80 h.p. engine maximum speed is increased to 165 km.h. (103 m.p.h.).



The Avianautic R.A. 14 Loisirs Light Monoplane (40 h.p. Train engine).

BLOCH.

SOCIÉTÉ DES AVIONS MARCEL BLOCH.

HEAD OFFICE: 46, AVENUE KLÉBER, PARIS.

WORKS: TALENCE.

The original Bloch company, known as Etablissements Marcel Bloch, was formed in 1931 and produced a number of military and civil designs. The Company was nationalised in January, 1937, and became part of the Société National de Constructions Aéronautiques de Sud-Ouest, particulars of which will be found in the appropriate place in this Section.

While the Bloch factories still remain in S.N.C.A.S.O. a new company with the above name has been formed, and is developing new commercial aircraft known as the M.B.300 and M.B.500, which are briefly described hereafter. The Company is also engaged in development of aero-engines and airscrews. Particulars of the Bloch engines will be found in Section D.

THE BLOCH M.B.300.

The M.B.300 is a twin-engined all-metal low-wing monoplane with a retractable tricycle landing gear and is intended for feeder-line duties. The cabin accommodates eight passengers. The first prototype, designated the M.B.303 has been completed and production is scheduled to begin at the Talence factory. The prototype is powered by two 390 h.p. Béarn 6D.07 six-cylinder in-line inverted air-cooled engines.

DIMENSIONS.—Span 18.47 m. (60 ft. 7 in.), Length 13.18 m. (43 ft. 3 in.), Wing area 39 sq. m. (419.6 sq. ft.).

WEIGHTS AND LOADINGS.—Weight loaded 5,540 kg. (12,213 lbs.), Wing loading 142 kg./sq. m. (28.65 lbs./sq. ft.), Power loading 7.1 kg./h.p. (15.65 lbs./h.p.).

PERFORMANCE.—Maximum speed 360 km.h. (224 m.p.h.), Cruising speed 320 km.h. (199 m.p.h.).

THE BLOCH M.B.500.

The M.B.500 is a twin-engined cantilever low-wing monoplane which at the time of writing was under construction. It is intended for touring purposes and will accommodate a pilot and four passengers. It is entirely of metal construction, with a twin-fin tail-unit, and a retractable two-wheel landing gear.

The power plant is to consist of two Bloch 4B four-cylinder in-line inverted air-cooled engines each developing 220 h.p. for take-off.

DIMENSIONS.—Span 15.40 m. (50 ft. 4¼ in.), Length 8.85 m. (29 ft. 0 in.), Wing area 28 sq. m. (301.28 sq. ft.).

WEIGHTS AND LOADINGS (Designed).—Weight loaded 2,200 kg. (4,850 lbs.), Wing loading 78.5 kg./sq. m. (16.06 lbs./sq. ft.), Power loading 5 kg./CV (11.18 lbs./h.p.).

PERFORMANCE (Estimated).—Maximum speed 300 km.h. (186 m.p.h.) at 1,000 m. (3,280 ft.), Cruising speed (70% power) 260 km.h. (162 m.p.h.), Landing speed 75 km.h. (47 m.p.h.), Rate of climb on one engine 120 m./min. (394 ft./min.), Range (with five passengers and 100 kg. = 220 lbs. luggage) 1,000 km. (621 miles).

BREGUET.

SOCIÉTÉ ANONYME DES ATELIERS D'AVIATION LOUIS BREGUET.

HEAD OFFICE: 24, RUE GEORGES-BIZET, PARIS 16E.

WORKS: TOULOUSE (HUNTE-GARONNE).

Managing Director and Chief Engineer: Louis Breguet.

The Breguet company was formed before the 1914-18 war by M. Louis Breguet, one of the great pioneers of French aviation.

Most of the former Breguet factories were incorporated into the nationalised industry in 1936, but in 1937 the Breguet company bought the Latécoère factories at Toulouse-Montaudran and Biscarosse.

During the Occupation, the Breguet factory at Villacoublay was used by the Junkers company as a repair and assembly plant. The Bayonne factory built outer wings for the Focke-Wulf Fw 189 under sub-contract from the S.N.C.A.S.O. The Breguet company also built two Blohm & Voss Bv 144 twin-engined transport prototypes for the German authorities.

For the Vichy Government the company was permitted to build a small series of the Latécoère 298 torpedo-seaplane and to undertake the construction of eight Breguet 730 reconnaissance flying-boats. It also developed the Breguet 500 twin-engined commercial monoplane.

The Company is at present engaged in the development of the Type 761 four-engined transport monoplane which can be adapted for a wide variety of military and civilian uses, and the Type 731 flying-boat. Activity is also centred around the G.II.E. Gyroplane, a development of the earlier Breguet helicopters.

THE BREGUET 761.

TYPE.—Four-engined Passenger or Freight Transport.

WINGS.—Cantilever mid-wing monoplane consisting of constant-chord centre-section carrying engines, and two tapered outer wings with rounded tips. Light alloy structure, with two spars, chordwise ribs and stressed metal skin. Aspect ratio 9.7; gross wing area 178.7 sq. m. (1,923 sq. ft.). Metal ailerons each in three sections on outer wings. Area (each) 9.2 sq. m. (99 sq. ft.). Breguet slotted flaps in four sections each side between ailerons and fuselage. Pneumatic operation. Total flap area 27.51 sq. m. (296 sq. ft.), flap depression 40 degrees.

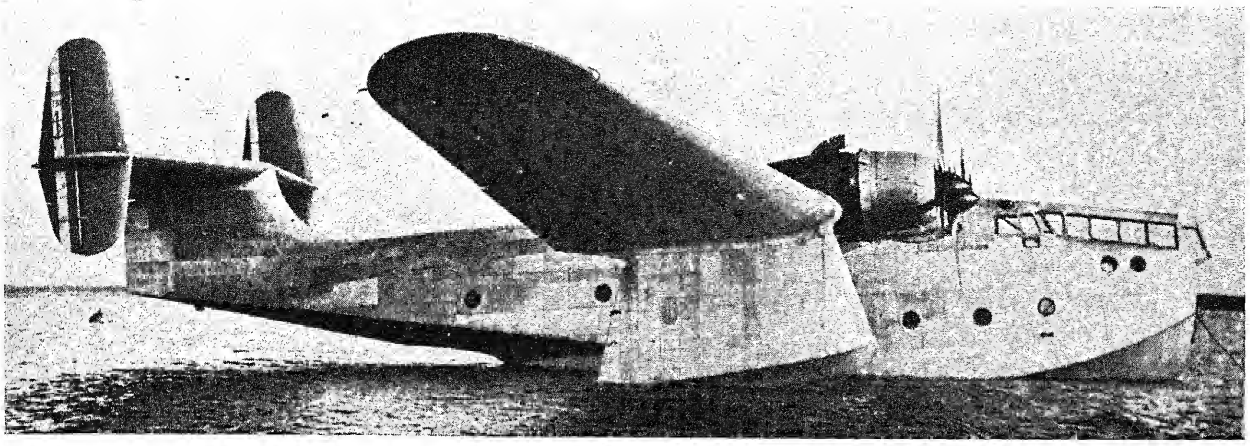
FUSELAGE.—Monocoque structure in five main sections consisting of nose section; centre-section; lower centre-section; rear section and tail end. Duralumin structure with Z-section transverse frames; laminated L-section longitudinal stringers and stressed metal skin. Two longitudinal beams in nose section to which nose-wheel is attached. Maximum fuselage width 3.30 m. (10 ft. 9½ in.), maximum depth 5.0 m. (16 ft. 5 in.).

TAIL UNIT.—All-metal cantilever structure consisting of tailplane and one-piece elevator mounted at top of fuselage and carrying twin fins and rudders inset from tips. Three trim and balance tabs in each surface. Total horizontal area 41.6 sq. m. (447.6 sq. ft.); total vertical area 15.896 sq. m. (171 sq. ft.).

LANDING GEAR.—Retractable tricycle type. Each main wheel carried on outside of single cantilever shock-absorber leg with rear bracing strut retracts forward into inner engine nacelle and is enclosed by two sets of twin doors. Track 7.52 m. (24 ft. 8 in.). Nose-wheel carried on levered suspension shock-absorber leg attached to two longitudinal members in nose-section retracts rearwards into fuselage and is enclosed by two sets of twin doors. Hydraulic operation.

POWER PLANT.—Four Gnôme-Rhône 14 R fourteen-cylinder two-row radial air-cooled engines each developing a normal output of 1,210 h.p. at 2,400 r.p.m. at sea level, and 1,590 h.p. at 2,600 r.p.m. for take-off. Engines mounted in tapered long-chord cowlings and driving Breguet-Ratier three-blade constant-speed airscrews, 3.70 m. (12 ft. 1½ in.) diameter. Goodrich airscrew de-icing. Total fuel capacity 13,240 litres (2,908 Imp. gallons); two 3,220 litre (708 Imp. gallon) tanks in outer wings; two 3,100 litre (680 Imp. gallon) tanks in centre-section, and two 300 litres (66 Imp. gallon) reserve tanks one in each outer engine nacelle. Oil capacity 1,100 litres (242 Imp. gallons) in four leading-edge tanks.

ACCOMMODATION.—Fuselage divided into two decks. Crew compartment in nose on upper deck with accommodation for four. Interior can be equipped for either passenger or freight transport. Upper deck has capacity of 89.3 cub. m. (5,137 cub. ft.) and lower deck 95.3 cub. m. (3,365 cub. ft.). Floor area (each deck) 84.2 sq. m. (906 sq. ft.). Internal dimensions (each deck), length 15 m.-16.30 m. (49 ft. 2½ in.-53 ft. 6 in.); width 2.70 m.-3.0 m. (8 ft. 10 in.-9 ft. 9½ in.); height 2 m.-2.10 m. (6 ft. 6½ in.-6 ft. 10 in.). Passenger version has 101 seats.



The Breguet 730 Reconnaissance Flying-boat, the prototype of the 731 Commercial Flying-boat.

Equipment.—Two 24-volt 3,900-watt electric generators. Breguet de-icing equipment.

Dimensions.—Span 41.66 m. (136 ft. 8 in.), Length 28.70 m. (94 ft. 1¾ in.), Height 8.30 m. (27 ft. 3 in.).

Weights and Loadings.—Weight empty 19,509 kg. (43,010 lbs.), Crew 360 kg. (794 lbs.), Fuel and oil 2,950 kg. (6,503 lbs.), Equipment 855 kg. (1,885 lbs.), Payload 14,326 kg. (31,583 lbs.), Weight loaded 38,000 kg. (83,775 lbs.), Maximum overloaded weight 42,000 kg. (92,593 lbs.), Wing loading 213 kg./sq. m. (43.6 lbs./sq. ft.), Power loading at take-off 5.6 kg./CV (12.5 lbs./h.p.).

Performance (Estimated).—Maximum speed 520 km.h. (323 m.p.h.), Cruising speed (60% power) 360 km.h. (224 m.p.h.), landing speed (with flaps) 139 km.h. (86 m.p.h.), Still-air range (fully loaded) 17,900 km. (11,123 miles), Take-off run 600 m. (656 yds.).

THE BREGUET 731

The Type 731 is a commercial development of the 730 military reconnaissance flying-boat described in the 1939 Edition of "All the World's Aircraft." Structurally the two types are identical but the new version is fitted with more powerful engines.

Type.—Four-engined Commercial Flying-boat.

Wings.—Cantilever high-wing monoplane. All-metal structure consisting of constant-chord centre-section and two tapered outer wings. Single main box-spar, the upper and lower members of which and the leading-edge are of sheet metal with spanwise corrugations. Smooth metal skin riveted to corrugated sheet. Fabric-covered metal ailerons on outer wings, with trailing-edge flaps in two sections each side between ailerons and hull. Aspect ratio 9.3 ; gross wing area 172 sq. m. (1,851 sq. ft.).

Hull.—All-metal single-step structure consisting of vertical frames, longitudinal stringers and stressed metal skin, and divided into watertight compartments. Length of hull 24.7 m. (79 ft.) ; maximum beam 3.4 m. (11 ft. 1 in.).

Floats.—Fixed stabilising floats at extremities of centre-section. All-metal structures, the sides continuing upwards and converging at junction with wing.

Tail Unit.—Metal braced structure consisting of tapered tailplane with single inset elevator mounted at top of upswept stern and braced to sides of hull, with twin fins and rudders inset from tips and disposed above and below tailplane. Balanced control surfaces are fabric-covered and fitted with controllable trim-tabs. Total horizontal area 33.6 sq. m. (361.6 sq. ft.), total vertical area 14 sq. m. (151 sq. ft.).

Power Plant.—Four Gnôme-Rhône 14R fourteen-cylinder two-row radial air-cooled engines each developing a maximum output of 1,480 h.p. for take-off and driving three-blade variable-pitch airscrews. Engines accessible in flight through wing. Fuel contained in centre-section main spar and in leading-edge of outer wings. Total capacity 18,000 litres (3,960 Imp. gallons).

Accommodation.—Hull divided into two decks. Crew of five accommodated in compartment at front of upper deck. Details of passenger and freight accommodation not available.

Dimensions.—Span 40.36 m. (132 ft. 5 in.), Length 24.35 m. (79 ft. (11 in.), Height 8.18 m. (26 ft. 10 in.).

Weights and Loadings (Approximate).—Weight empty 18,700 kg. (41,226 lbs.), Disposable load 16,300 kg. (35,935 lbs.), Weight loaded 35,000 kg. (77,161 lbs.), Wing loading 203.5 kg./sq. m. (41.7 lbs./sq. ft.), Power loading (at take-off) 5.9 kg./h.p. (13 lbs./h.p.).

Performance (Estimated).—Maximum speed 385 km.h. (239 m.p.h.) at 2,600 m. (8,530 ft.), Cruising speed (65% power) 300 km.h. (186 m.p.h.) at 2,500 m. (8,200 ft.), Climb to 2,000 m. (6,560 ft.) 13 minutes, Range 4,850 km. (3,014 miles), Take-off time 50 seconds.

THE BREGUET 500 COLMAR.

Type.—Twin-engined Airliner.

Wings.—Cantilever mid-wing monoplane. All-metal structure with main spar at 26% chord and two auxiliary spars. Duralumin sheet covering. Slotted double flaps between ailerons and fuselage. Wing area 66.73 sq. m. (718 sq. ft.).

Fuselage.—All-metal structure of oval cross-section.

Tail Unit.—All-metal cantilever structure with inset twin fins and rudders.

Landing Gear.—Retractable two-wheel type. Each main wheel carried between pair of shock-absorber legs retracts rearwards into engine nacelle and is enclosed by twin doors.

Power Plant.—Two Gnôme-Rhône 15 R.5 fourteen-cylinder two-row radial air-cooled engines enclosed in tapered long-chord cowlings each developing a normal output of 1,210 h.p. at sea level and with a maximum of 1,600 h.p. available for take-off. Three-blade airscrews.

Accommodation.—Crew compartment forward. Main cabin is divided into two sections, the forward section seating six passengers and the rear section seventeen. Eight baggage holds with total capacity of 11 cub. m. (388 cub. ft.).

Dimensions.—Span 24.12 m. (79 ft. 1½ in.), Length 19.955 m. (65 ft. 5½ in.), Height 4.80 m. (15 ft. 9 in.).

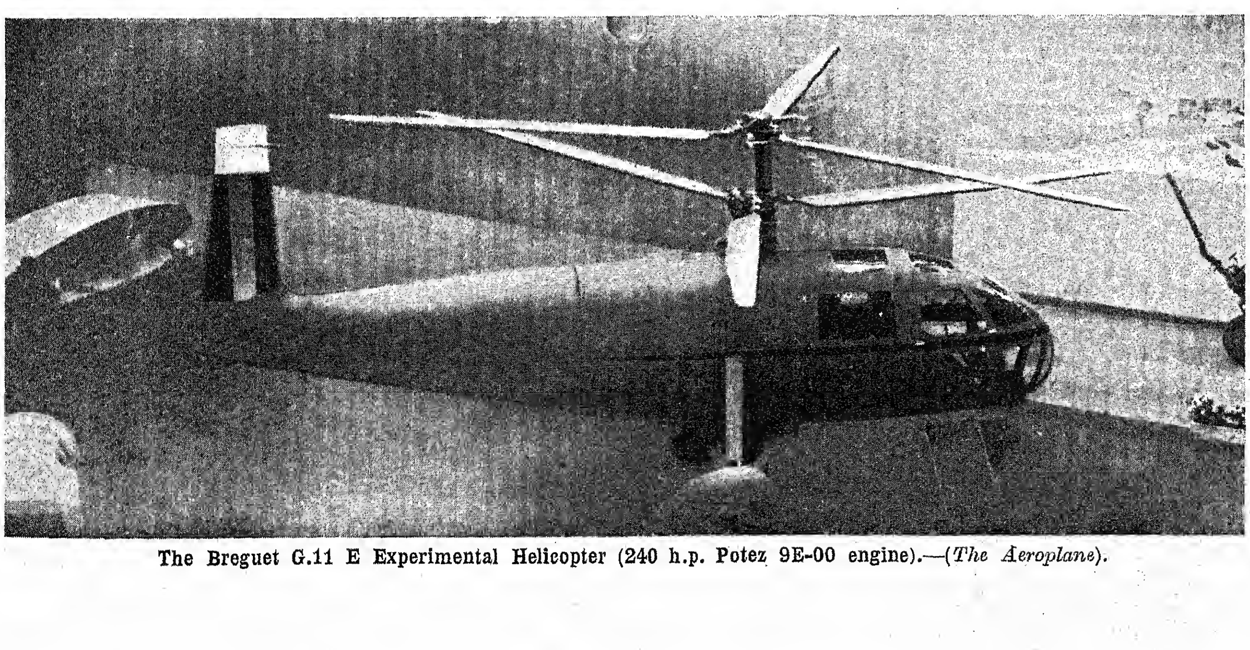
Weights and Loadings.—Weight loaded 14,380 kg. (31,702 lbs.), Wing loading 214 kg./sq. m. (43.8 lbs./sq. ft.), Power loading 4.49 kg./h.p. (9.9 lbs./h.p.).

Performance (Approximate).—Cruising speed 400 km.h. (249 m.p/.h.), Cruising range 2,000 km. (1,243 miles).

THE BREGUET G.II E GYROPLANE.

Type.—Three-seat Commercial Helicopter.

Rotors.—Two three-blade oppositely-rotating co-axial rotors 8.60 m. (28 ft. 2½ in.) diameter mounted on vertical shaft above fuselage.



The Breguet G.11 E Experimental Helicopter (240 h.p. Potez 9E-00 engine).—(*The Aeroplane*).

BREGUET—continued.

Each rotor blade consists of a steel-tube main spar, chordwise ribs, light-alloy leading-edge and a Plymax covering. Forged steel rotor hubs containing cyclic pitch control. Transmission by a disc clutch and reduction gear of 1 : 6.5 ratio permitting rotor speed of 2,600 r.p.m. for an engine speed of 400 r.p.m. Free-wheeling device permits auto-rotation in event of engine failure.

Fuselage.—Light-alloy monocoque structure built in two main sections. Forward section accommodates pilot and passenger cabin, and detachable rear section carries engine, landing gear and tail-unit.

Tail Unit.—Cantilever structure consisting of all-metal vertical fin mounted at extreme stern of fuselage with variable-incidence tailplane at top. Tailplane has metal framework and fabric covering.

Landing Gear.—Fixed tricycle type. Main wheels carried on axles attached to structure under fuselage and oleo-pneumatic shock-absorber legs extending from sides of fuselage. Nose-wheel carried in fork on shock-absorber leg under forward section of fuselage. Track 2.80 m. (9 ft. 2 in.). Emergency bumper-skid under rear fuselage.

Power Plant.—One 240 h.p. Potez 9E-00 nine-cylinder radial air-cooled engine mounted in rear section of fuselage aft of cabin.

Accommodation.—Enclosed cabin seating pilot in front and second pilot or two passengers behind. Access door on port side. Vertical flight control by variation of incidence of rotor blades and by variation of the angle of incidence of the tailplane. Directional control by differential variation of the incidence of the rotor blades.

Dimensions.—Rotor diameter 8.60 m. (28 ft. 2¼ in.), Length of fuselage 9.20 m. (30 ft. 2 in.), Length overall (rotors in optimum position) 9.90 m. (32 ft. 5½ in.), Height 4.05 m. (13 ft. 3 in.).

Weights (Designed).—Weight empty 850 kg. (1,874 lbs.), Weight loaded 1,300 kg. (2,866 lbs.).

Performance (Estimated).—Maximum speed 240 km.h. (149 m.p.h.), Cruising speed 175 km.h. (109 m.p.h.) at 1,000 m. (3,280 ft.), Ceiling 4,000 m. (13,125 ft.), Fuel consumption 30 litres/100 km. (9.4 Imp. gallons/100 miles).

THE BREGUET-LEDUC O.10.

The Leduc O-10 is an experimental monoplane built by the Breguet company to the designs of M. René Leduc for high-speed flight research purposes. It is an all-metal mid-wing monoplane with a cylindrical fuselage and is powered by an athodyd unit. A pilot and a research engineer for making observations are accommodated in the conical nose-section, which can be jettisoned.

Aerodynamic tests were being made at the time of writing with the O-10 mounted on a structure fitted above an S.E.161 Languedoc, the first flight having been made on November 16, 1946. Subsequent tests are to be made with the O-10 launched as a glider and later under its own power.

The O-10 has a span of 11 m. (36 ft. 1 in.) and a maximum speed of 1,000 km.h. (621 m.p.h.) is expected.

CARMIER.

This Company has produced the T-10 single-seat light parasol monoplane powered by a 40-50 h.p. Train engine. A specification of this aircraft follows.

THE CARMIER T-10.

Type.—Single-seat Parasol Monoplane.

Wings.—Strut-braced parasol monoplane. Thick concave aerofoil section of Göttingen series. Constant-chord wing built in two sections and attached to central *cabane*, with tubular V-strut bracing on each side. Structure consists of two main spars 46 c/m. (18 in.) apart, chordwise ribs and false spar carrying ailerons. All-wood structure with ply-wood covering. Gross wing area 9.4 sq. m. (101 sq. ft.). Steel-tube ailerons extend over full span, except for cut-out over fuselage. Differential mechanism allows ailerons to operate simultaneously as flaps and adjusts elevators to compensate for displacement of centre of pressure. Aileron chord 20 c/m. (7.9 in.).

Fuselage.—All-wood structure with four longerons, transversal frames and longitudinal stringers with plywood covering. Fuselage length (from engine bulkhead to sternpost 3.60 m. (11 ft. 9½ in.); depth 0.85 m. (2 ft. 9½ in.); width 0.72 m. (2 ft. 4 in.).

Tail Unit.—Monoplane type. Fin integral with fuselage and strut-braced tailplane of wooden construction with plywood covering. Elevators and rudders have welded steel-tube frames and fabric covering.

Landing Gear.—Fixed two-wheel split type. Main wheels 0.40 m. (1 ft. 4 in.) diameter, carried on sprung half-axles attached to fuselage centre-line, with side vees attached to lower longerons. Leg travel 20 c/m. (7.8 in.). Track 1.60 m. (5 ft. 3 in.). Tail-skid attached to fuselage sternpost.

Power Plant.—One Train four-cylinder in-line inverted air-cooled engine developing 40-50 h.p. and mounted on autogenously-welded steel-tube bearer attached by four points to fire-proof bulkhead. Merville two-blade wooden airscrew 1.60 m. (5ft. 3 in.) diameter; clearance 25 c/m. (9¾ in.). Zenith carburettor. Fuel tank in fuselage behind engine.

Accommodation.—Open cockpit for pilot under wing cut-out.

Dimensions.—Span 8.0 m. (26 ft. 3 in.), Length 5.0 m. (16 ft. 5 in.).

Weights and Loadings.—Weight empty 235 kg. (518 lbs.), Pilot and parachute 85 kg. (187 lbs.), Fuel, oil and baggage 55 kg. (121 lbs.), Weight loaded 375 kg. (826 lbs.). Wing loading 40 kg./sq. m. (8.2 lbs./sq. ft.), Power loading 9.3 kg./h.p. (20.5 lbs./h.p.).

Performance.—Maximum speed 165 km.h. (103 m.p.h.) at sea level, Cruising speed at 70% power 144 km.h. (89 m.p.h.), Landing speed 55 km.h. (34 m.p.h.), Climb 150 m./min. (492 ft./min.), Climb to 360 m. (1,180 ft.) 2¼ minutes, Ceiling 4,000 m. (12,125 ft.), Range at cruising speed 450 km. (280 miles), Maximum range 520 km. (323 miles), Take-off distance to 42.5 m. (140 ft.) 600 m. (656 yds.), Landing distance from 42.5 m. (140 ft.) 355 m. (388 yds.), Landing run (no wind) 95 m. (104 yds.), Fuel consumption 12 litres (2¾ Imp. gallons) per hour.

COLOMBES.

ATELIER AÉRONAUTIQUE DE COLOMBES.

Administrative Office: 12, Faubourg Saint-Honoré, Paris (8e.).

Works: 151-173, Boulevard Charles de Gaulle, Colombes (Seine).

Director-General: M. Guista.

The Atelier Aéronautique de Colombes is the former Amiot (S.E.C.M.) Company which is now nationalised and operating under the direction of the Ministry of Armaments.

The former Amiot Company came under the control of the Junkers Company during the German occupation and was made responsible for the production in France of the Ju 52 three-engined transport.

The nationalised Atelier Aéronautique de Colombes has continued the production of this aircraft for the French Government under the designation AAC-1, but this will shortly cease. In the meantime the Colombes plant has been rented by the Société Nationale de Constructions du Centre (Aérocentre).

GUERCHAIS ROCHE.

ROCHE AVIATION.

Head Office: 23, Boulevard des Italiens, Paris (9e).

Works: La Courneuve (Seine) and Riom (Puy de Dome).

Director-General: François Roche.

Assistant Director-General: M. Roy.

Chief Engineer: M. Guerchais

Roche Aviation has produced the Types 30 and 35 two-seat light cabin monoplanes, and the Type 39 three-seat version. It is also engaged in the design of gliders, and the Type 107 has been produced. Descriptions of these aircraft follow.

THE GUERCHAIS ROCHE TYPE 35.

Type.—Two-seat Touring and Training Monoplane.

Wings.—Cantilever low-wing monoplane. Wooden structure in one piece with okoumé plywood covering forward and fabric aft. Slotted ailerons, with trim-tab in starboard. Slotted trailing-edge flaps between ailerons and fuselage. Wing area 13.5 sq. m. (145.26 sq. ft.).

Fuselage.—Wooden box structure with plywood and fabric covering.

Tail Unit.—Cantilever monoplane type. Wooden structure with ply-covered fixed surfaces and fabric-covered rudder and elevators.

Landing Gear.—Fixed two-wheel type. Each main wheel carried on oleo-pneumatic shock-absorber leg attached to front spar, and faired by metal spat. Wheel brakes. Tail-wheel carried on oleo-spring shock-absorber leg.

Power Plant.—One 140 h.p. Renault four-cylinder in-line air-cooled engine mounted on rubber-faced anti-vibration steel-tube bearer and driving two-blade fixed-pitch wooden airscrew. Three fuel tanks, one of 90 litres (20 Imp. gallons) and two of 55 litres (12 Imp. gallons) in wings. Oil tank of 11 litres (2.4 Imp. gallons) capacity on engine bulkhead.

Accommodation.—Enclosed cabin seating two side-by-side with dual controls. Access door on each side hinges forward.

Dimensions.—Span 9.30 m. (30 ft. 6 in.), Length 7.25 m. (23 ft. 9½ in.), Height 2.10 m. (6 ft. 10½ in.).

Weights and Loadings.—Weight empty (equipped) 539 kg. (1,188 lbs.), Weight loaded 847 kg. (1,867 lbs.), Wing loading 62.7 kg./sq. m. (12.84 lbs./sq. ft.), Power loading 6.05 kg./CV (13.5 lbs./h.p.).

Performance.—Maximum speed 240 km.h. (149 m.p.h.) at sea level, Cruising speed 215 km.h. (134 m.p.h.), Landing speed (with flaps) 55 km.h. (34 m.p.h.), Ceiling 6,500 m. (21,325 ft.), Range 800 km. (497 miles).

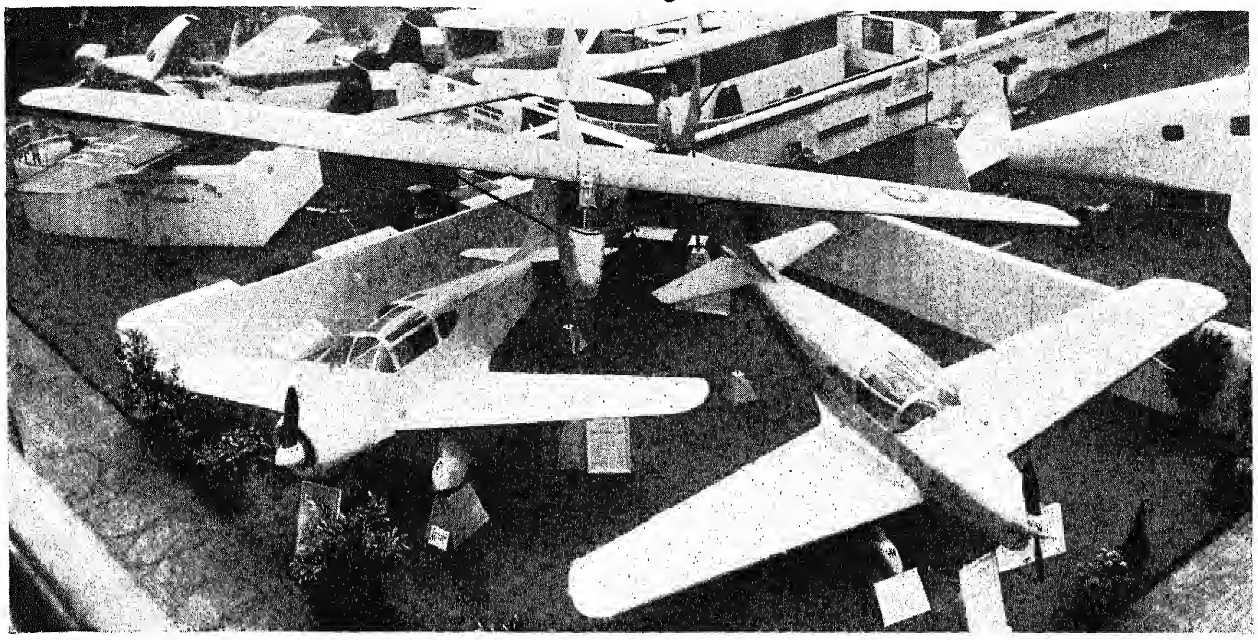
THE GUERCHAIS ROCHE T.39.

The Type 39 is generally similar to the Type 35 but is a three-seater and is powered by a 175 h.p. Mathis G.7R seven-cylinder radial air-cooled engine driving a Regy two-blade fixed-pitch wooden airscrew.

Dimensions.—As Type 35.

Weights and Loadings.—Weight empty 535 kg. (1,180 lbs.), Weight loaded 912 kg. (2,010 lbs.), Wing loading 6.28 kg./sq. m. (12.34 lbs./sq. ft.), Power loading 5.2 kg./CV (11.62 lbs./h.p.).

Performance.—Maximum speed 254 km.h. (158 m.p.h.), Cruising speed 230 km.h. (143 m.p.h.), Landing speed (with flaps) 64 km.h. (40 m.p.h.), Landing speed (without flaps) 80 km.h. (50 m.p.h.), ceiling 7,000 m. (22,965 ft.).



The Guerchais Roche stand at the 1946 Paris Aero Show shewing (left) the T.39 Three-seat Monoplane; (centre) the T.107 Glider and (right) the T.35 Two-seat Touring Monoplane.—(*The Aeroplane*).

THE GUERCHAIS ROCHE T.30.

The Type 30 is a two-seat cabin monoplane from which the Type 35 was developed. It is similar in appearance and construction, but is powered by a 90 h.p. Ford V-8 eight-cylinder air-cooled engine driving a two-blade wooden airscrew.

Performance.—Maximum speed 196 km.h. (122 m.p.h.), Cruising speed 170 km.h. (106 m.p.h.), Landing speed 65 km.h. (40 m.p.h.), Ceiling 6,000 m. (19,685 ft.), Range 520 km. (323 miles).

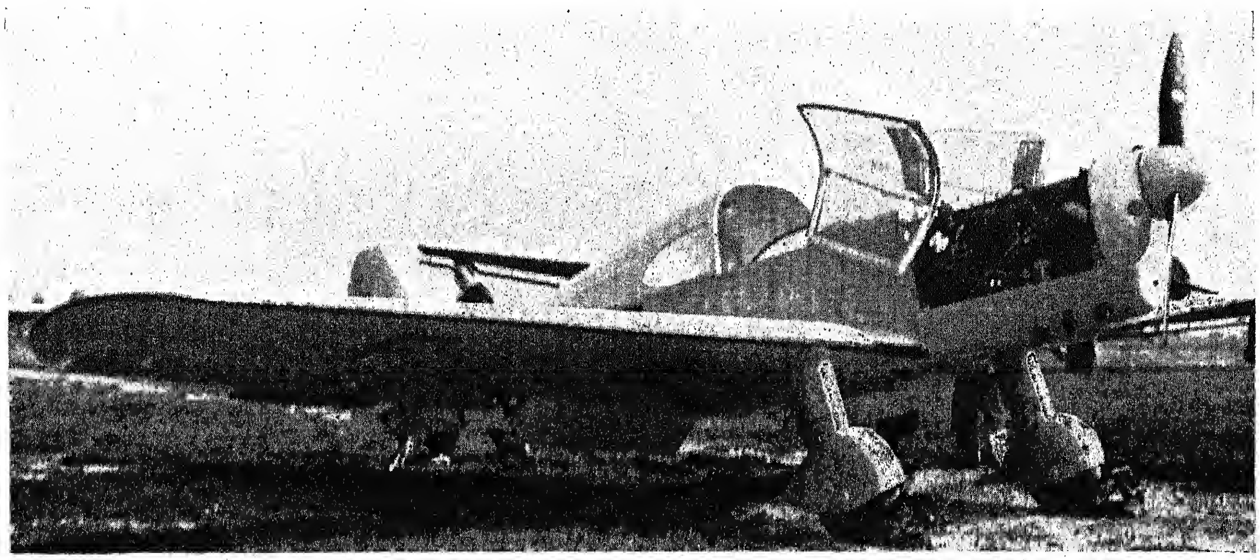
THE GUERCHAIS ROCHE T.107.

The Type 107 is a single-seat training glider of wooden construction. It has a high wing with tapered outer sections, braced to the fuselage by a single strut on each side. It has an orthodox cantilever monoplane tail-unit, and the landing gear consists of a single central skid under the fuselage, and a non-retractable tail-wheel. The pilot is accommodated in an enclosed cockpit ahead of the wing.

Dimensions.—Span 13.80 m. (45 ft. 3½ in.), Wing area 15 sq. m. (162 sq. ft.).

Weight Empty.—133 kg. (293 lbs.).

Performance.—Minimum speed 40 km.h. (25 m.p.h.).



The Guerchais Roche T.35 Two-seat Cabin Monoplane (140 h.p. Renault engine).

GYROPLANE.

SOCIÉTÉ FRANÇAIS DU GYROPLANE.

This company has produced the Gyroplane G-20, a two-seat helicopter for observation, liaison or mail-carrying duties. It is powered by a 240 h.p. engine mounted in the fuselage which drives two three-blade co-axial contra-rotating rotors mounted on a pylon over the fuselage. The fuselage is a tapered cylindrical structure terminating in a dihedral tailplane. A fixed two-wheel landing gear is fitted.

Dimensions.—Rotor diameter 15.40 m. (60 ft. 6½ in.), Length 11.0 m. (36 ft. 4 in.), Height 3.13 m. (10 ft. 3 in.), Rotor blade area 20.436 sq. m. (219.9 sq. ft.).

Weights.—Weight empty 1,400 kg. (3,086 lbs.), Normal weight loaded 2,500 kg. (5,512 lbs.), Maximum weight loaded 3,000 kg. (6,614 lbs.).

Performance (Estimated).—Maximum speed 250 km.h. (155 m.p.h.) at 2,500 m. (8,200 ft.), Ceiling 5,000 m. (16,405 ft.), Hovering ceiling 3,000 m. (9,840 ft.), Still-air range 800 km. (497 miles).

M.D.G.

MATERIEL DENIS-GRUSON.

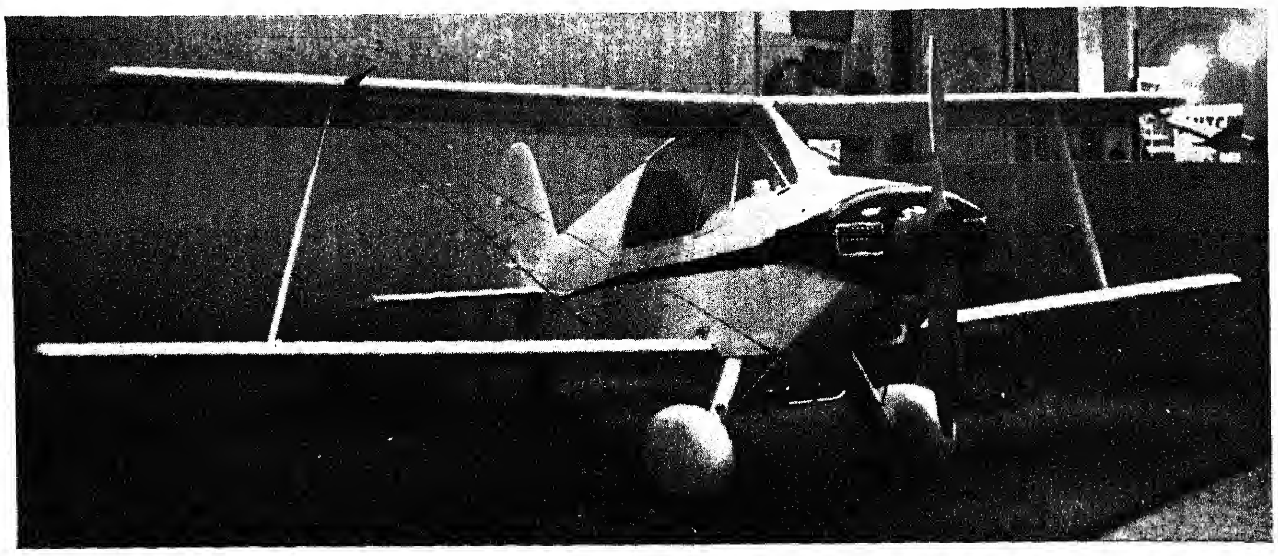
Head Office : 81, Rue de Villeneuve, Garches (S-et-O).
Works : Viroflay (S-et-o).
Directors : Maurice Denis and M. Gruson.
Technical Director : M. Delasalle.

This firm of precision instrument manufacturers was formed some years prior to the late War, and has now produced the 40 h.p. L.D.45 single-seat light biplane. The L.D. 45 is intended to be produced cheaply in large numbers, and will be available with either a wooden or a metal fuselage. Production had begun at the time of writing.

THE M.D.G. L.D. 45.

The L.D. 45 is a single-seat open or enclosed biplane which is built in wood or metal versions. It is a single-strut and wire-braced biplane, with the upper wing of shorter span than the

***M.D.G.**—continued.*



The M.D.G. L.D. 45 Single-seat Light Biplane (40 h.p. Mathis G2F engine).—(*The Aeroplane*).

lower. Manually-operated full-span slotted flaps are fitted to the upper wings and slotted ailerons occupy the whole of the trailing-edge of the lower wings.

The landing gear is of the fixed two-wheel type, the main wheels being carried on wire-braced shock-absorber struts and faired with spats. The tail-wheel is steerable.

The power plant normally consists of a 40 h.p. Mathis G.2F two-cylinder horizontally-opposed air-cooled engine driving a Regy two-blade wooden airscrew, but the L.D. 45 is also available with a 70 h.p. Echard engine.

DIMENSIONS.—Span (lower wing) 5.90 m. (19 ft. 4 in.), Length 4.40 m. (14 ft. 5 in.), Height 1.85 m. (6 ft. 0¾ in.), Wing area 7 sq. m. (75.32 sq. ft.), Aspect ratio 9.

WEIGHTS AND LOADINGS (Mathis engine).—Weight loaded 285 kg. (628 lbs.), Wing loading 40.7 kg./sq. m. (8.33 lbs./sq. ft.), Power loading 7.1 kg./CV (15.86 lbs./h.p.).

PERFORMANCE (Mathis engine).—Maximum speed 162 km.h. (101 m.p.h.), Cruising speed (75% power) 145 km.h. (90 m.p.h.), Landing speed (with flaps) 58 km.h. (36 m.p.h.), Duration 3 hrs., Fuel consumption 11 litres (2.42 Imp. gallons) per hour.

PERFORMANCE (Echard engine).—Maximum speed 207 km.h. (129 m.p.h.), Cruising speed 188 km.h. (117 m.p.h.), Rate of climb 480 m./min. (1,575 ft./min.), Climb to 1,000 m. (3,280 ft.) 2¾ minutes, Landing run 40 m. (44 yds.), Take-off distance to 15 m. (50 ft.) 100 m. (109 yds.).

MATRA.

SOCIÉTÉ GÉNÉRALE DE MECHANIQUE, AVIATION, TRACTION (MATRA).

HEAD OFFICE AND WORKS: 10, RUE VILLOT, LA COURNEUVE (SEINE).

The Société Matra is a general engineering firm which has only recently entered the aircraft industry. It has taken over a factory formerly belonging to the Société Bernard, and has placed it in the charge of M. Roger Robert, who was also a member of the technical staff of the old Bernard company.

During the occupation M. Robert evolved several aircraft designs, including a twin-engined single-airscrew fighter of original conception. To avoid arousing the curiosity of the occupying forces a model incorporating the novel engine installation was built in the form of a four-seat touring aeroplane and this project—the R-75 is now being developed by Matra.

The R-75 is a twin-boom central nacelle monoplane with two 175 h.p. Mathis engines located in the noses of the booms and driving a single pusher airscrew at the aft end of the central nacelle through gears and shafts. Another feature of the R-75 design is the absence of ailerons on the wings. Lateral control will be assured by the differential control of elevators which will be mounted on extensions of the fixed tail surface outboard of the tail-booms and fins and rudders. The entire trailing-edge of the wings will be occupied by flaps.

The R-75 will have accommodation for four in two pairs in the central nacelle. It will have an estimated maximum speed of 350 km.h. (217.3 m.p.h.). Should one engine fail it is estimated that a speed of 250 km.h. (155.2 m.p.h.) will be maintained with the remaining engine.

MAUBOUSSIN.

ÉTABLISSEMENTS FOUGA ET CIE.

HEAD OFFICE: BÉZIERS (HÉRAULT).

AIRCRAFT DEPARTMENT AND WORKS: AIRE-SUR-L'ADOUR (LANDES).

Technical Director (Aircraft): Pierre Mauboussin.

Director of Production: P. Quoix.

The Établissement Fouga has operated an Aircraft Department since 1936 and since that year has built aircraft to the designs of M. Pierre Mauboussin. M. Mauboussin's design office, which had retained its independence until just after the liberation of France, has now been taken over by the Company, together with certain principal elements of the design office of the former Dewoitine company.

The works at Aire-sur-l'Adour, covering an area of 14,000 sq. m. (150,640 sq. ft.), is situated alongside an aerodrome which the company has built with the assistance of the local municipality and the State.

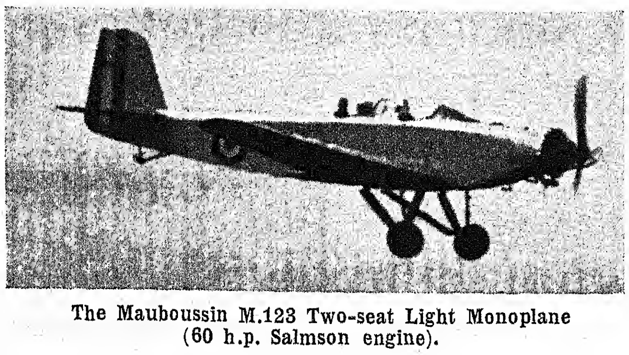
The types of aircraft which the Company has built or is building include the Mauboussin M.123 and its derivatives, a light training or touring monoplane; the M.200 and M.202, single-seat light aircraft, the former being the holder of international speed records over 100 and 1,000 km.; the M.300, a twin-engined liaison aircraft which is undergoing trials; and the C.M.100 a twin-engined passenger or freight transport, which is being built in prototype form.

The Company has also designed and built a series of sailplanes and gliders under the designation Castel-Mauboussin. Since 1941 they have been widely used in French gliding centres.

The C.25S, C.30S and C.300S have been built in quantity, the C.300S under licence by the Société Nationale de Constructions Aéronautiques du Centre. Types under development include the C.M.7 two-seat high-performance sailplane; the C.M.8 single-seat aerobatic sailplane; the C.M.10 troop-carrying glider and the C.M. Jalon, a two-seat experimental sailplane which has been developed at the request of the Groupement Français pour le developpement des Researches Aéronautiques (G.R.A.). The C.M.10 troop-carrying glider is being built in prototype form by the Etablissements Fouga and will be produced in series in the Caudebec and Sartrouville factories of the S.N.C.A.du Nord

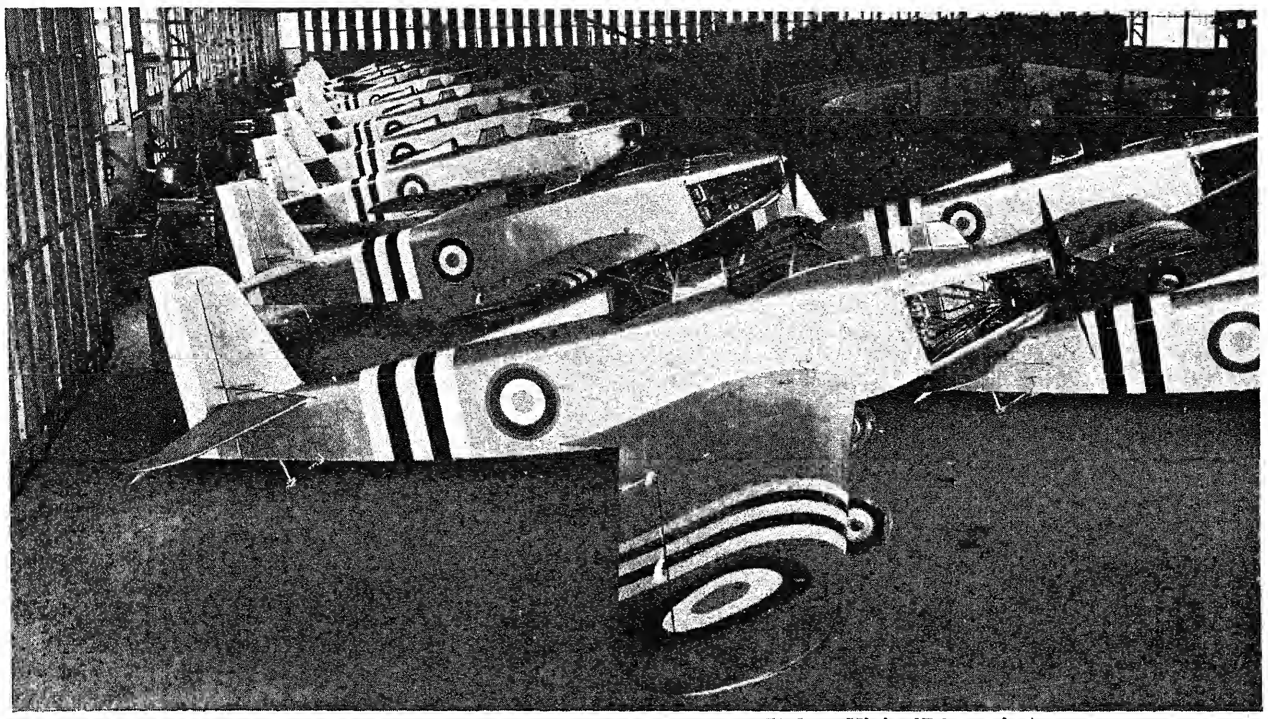
THE MAUBOUSSIN M.123.

The M.123 was first built in series by the Établissements Fouga in 1937. This early version was fitted with a 60 h.p. Salmson engine and it has since been superseded by the M.124, M.128 and M.129, all with similar airframes but with different types of engines. The M.128 and M.129 have tandem open cockpits, whereas the M.124 has enclosed cockpits.



The Mauboussin M.123 Two-seat Light Monoplane (60 h.p. Salmson engine).

***MAUBOUSSIN**—continued.*



The Mauboussin M.129 Two-seat Light Monoplane (70 h.p. Minie 4DO engine).

THE MAUBOUSSIN M.124.

TYPE.—Two-seat Light Touring and Training monoplane.

WINGS.—Low-wing cantilever monoplane. Wings of high aspect ratio with constant taper and blunt tips. Structure consists of two box spars, box compression ribs, spruce and plywood former ribs and a plywood skin. Entire trailing-edge hinged, inner portions acting as flaps.

FUSELAGE.—Rectangular wooden structure with domed top. Spruce longerons and vertical and cross members and plywood covering.

TAIL UNIT.—Cantilever monoplane type. Structure similar to that of wings.

LANDING GEAR.—Fixed type. Two pyramid units each incorporating a vertical Messier shock strut anchored to the front wing spar and a Vee axle hinged to the bottom fuselage longerons.

POWER PLANT.—One 85 h.p. Salmson 5AP.01 five-cylinder radial air-cooled engine. Fuel tank in fuselage.

ACCOMMODATION.—Tandem cockpits with dual controls. Transparent canopy over both cockpits and extending aft nearly to the tail unit.

DIMENSIONS.—Span 10.4 m. (34 ft. 1 in.), Length 6.9 m. (22 ft. 7½ in.), Height 2.525 m. (8 ft. 3 in.).

WEIGHTS.—No data available.

PERFORMANCE.—Maximum speed 180 km.h. (112 m.p.h.), Cruising speed 155 km.h. (96.2 m.p.h.), Ceiling 6,500 m. (21,320 ft.), Range 600 km. (372 miles).

THE MAUBOUSSIN M.128.

The M.128 is similar to the M.124 but is fitted with a 100 h.p. Mathis G.4R eight-cylinder inverted Vee air-cooled engine.

PERFORMANCE.—Maximum speed 190 km.h. (118 m.p.h.), Cruising speed 165 km.h. (102.4 m.p.h.), Ceiling 7,000 m. (22,965 ft.), Range 620 km. (385 miles).

THE MAUBOUSSIN M.129.

The M.129 is similar to the M.128 but is fitted with a 70 h.p. Minie 4DO four-cylinder horizontally-opposed air-cooled engine.

DIMENSIONS.—Span 11.75 m. (38 ft. 6 in.), Length 7 m. (23 ft.), Height 2.525 m. (8 ft. 3 in.), Wing area 13.6 sq. m. (146.3 sq. ft.).

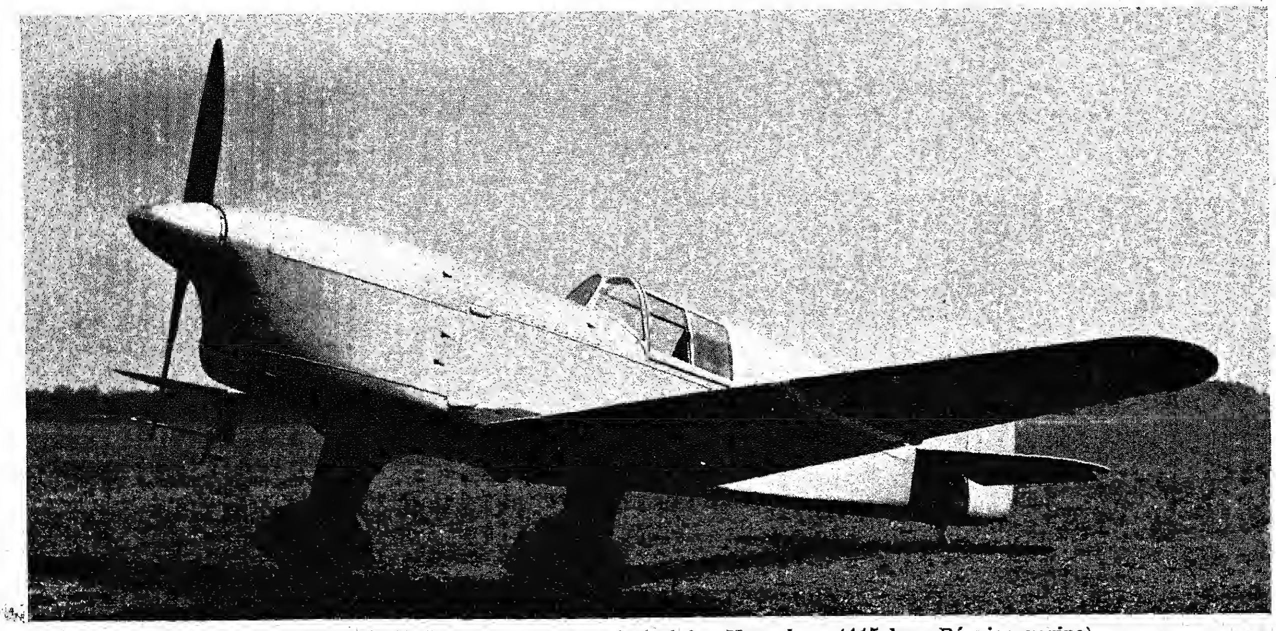
WEIGHTS.—Weight empty 390 kg. (858 lbs.), Weight loaded 625 kg. (1,375 lbs.).

PERFORMANCE.—Maximum speed 165 km.h. (102.4 m.p.h.), Minimum speed 85 km.h. (52.7 m.p.h.), Landing speed 60 km.h. (37.3 m.p.h.) Service ceiling 4,500 m. (14,765 ft.), Range 630 km. (390 miles).

THE MAUBOUSSIN M.200.

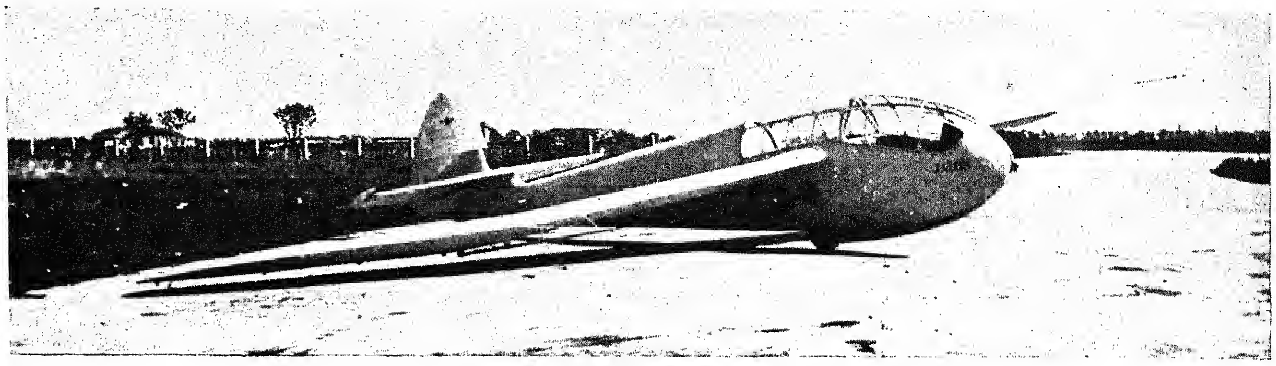
The M.200 is a single-seat high-performance monoplane of all-wood construction and is fitted with a 115 h.p. Régnier four-cylinder inverted air-cooled engine. In May, 1939, this aeroplane put up speed records over 100 km. (62 miles) and 1,000 km. (621 miles) for light aeroplanes with engines of from 2-4 litres capacity with speeds of 274.223 km.h. (170.29 m.p.h.) and 225 km.h. (158.57 m.p.h.) respectively.

The latest version of this aeroplane, the M.202, is illustrated herewith. The M.202 was under development before the war as a single-seat advanced trainer and work on it was continued after the Armistice and until the German occupation.



The Mauboussin M.202 Single-seat Advanced Training Monoplane (115 h.p. Régnier engine).

MAUBOUSSIN—*continued.*



The Castel-Mauboussin C.M. Jalon Two-seat Research Glider.

THE MAUBOUSSIN M.300.

The M.300 was designed before the German occupation as a light six-passenger transport but at the request of the Vichy Government it was later converted to a three or four-seat liaison or training aircraft.

It is a low-wing monoplane with retractable landing-gear and twin-ruddered tail-unit and is fitted with two 220 h.p. Renault six-cylinder inverted air-cooled engines. Since the liberation the aircraft has been completed and at the time of writing was about to begin its trials.

THE CASTEL-MAUBOUSSIN C.M. JALON.

The Jalon has been designed and built to the order of the Groupement Français pour le Developpement des Researches Aéronautiques (G.R.A.). With pilot and observer on board, it can carry a useful load of 50 kg. (110 lb.) represented by the installation of laboratory instruments and equipment. It can be towed at a speed of 150 km.h. (93 m.p.h.).

Type.—Two-seat Research Glider.

Wings.—Mid-wing cantilever monoplane. Aspect ratio 10.8. Inner half of each wing of constant chord and thickness, outer half tapered and with rounded tips. Monospar wood structure with plywood covering. Wing area 18.4 sq. m. (198 sq. ft.).

Fuselage.—Oval wood monocoque structure.

Tail Unit.—Cantilever monoplane type. Wood structure. Horn-balanced elevators and rudder.

Landing Gear.—Rubber-sprung central skid with centrally mounted balloon wheel half buried in the fuselage aft of skid.

Accommodation.—Tandem enclosed cockpits with pilot in front with complete flight instrument equipment. Large observer's cockpit with ample space for installation of special recording instruments, etc.

Dimensions.—Span 14.1 m. (46 ft. 6 in.). Length 7.78 m. (25 ft. 6 in.), Height 2.33 m. (10 ft. 6 in.).

Weights.—Tare weight 300 kg. (661 lbs.), Fixed equipment 22 kg. (48.4 lbs.), Weight empty 322 kg. (708.4 lbs.), Crew 154 kg. (338.8 lbs.), Useful load 50 kg. (110 lbs.), Weight loaded 525 kg. (1157.2 lbs.).

Performance.—Maximum towing speed 150 km.h. (93 m.p.h.), Speed at best gliding angle 95 km.h. (59 m.p.h.), Rate of descent at 100 km.h. (62.1 m.p.h.) 1 m./sec. (3.28 ft./sec.).

MAX HOLSTE.

AVIONS MAX HOLSTE.

Head Office 63, Avenue des Champs-Élysées, Paris (8e).

President: René Larousse.

General Director: Max Holste.

Assistant General Director: Charles Dalaudière.

Avions Max Holste is an independent manufacturing firm which produces the M.H.52 all-metal two-seat Training or Touring monoplane powered by a 150 h.p. Potez 4D engine, or a smaller four-cylinder in-line or horizontally-opposed engine of 95-100 h.p. Descriptions of the various models follow.

Earlier Max Holste designs have included the M.H.20 built to compete in the Coupe Deutsch de la Meurthe of 1939. This was an all-metal low-wing monoplane powered by a 365 h.p. Régnier 12 H-00 six-cylinder in-line inverted air-cooled engine, which attained a speed of 472 km.h. (293 m.p.h.). In 1942 a twin-boom single-seat sailplane known as the 20 PG-1 was produced. It was constructed entirely of duralumin and had a tapered wing with a span of 17.50 m. (57 ft. 4¾ in.) and an aspect ratio of 17. An experimental single-seat low-wing monoplane known as the S.25 was partly completed in 1944. It was built entirely of magnesium and was to be powered by a 75-80 h.p. engine. Both of these latter aircraft were destroyed on June 22, 1944, when an Allied aircraft, hit by anti-aircraft fire, jettisoned its bombs on the factory.

A projected twin-engined version of the M.H.52 is designated the M.H.60.

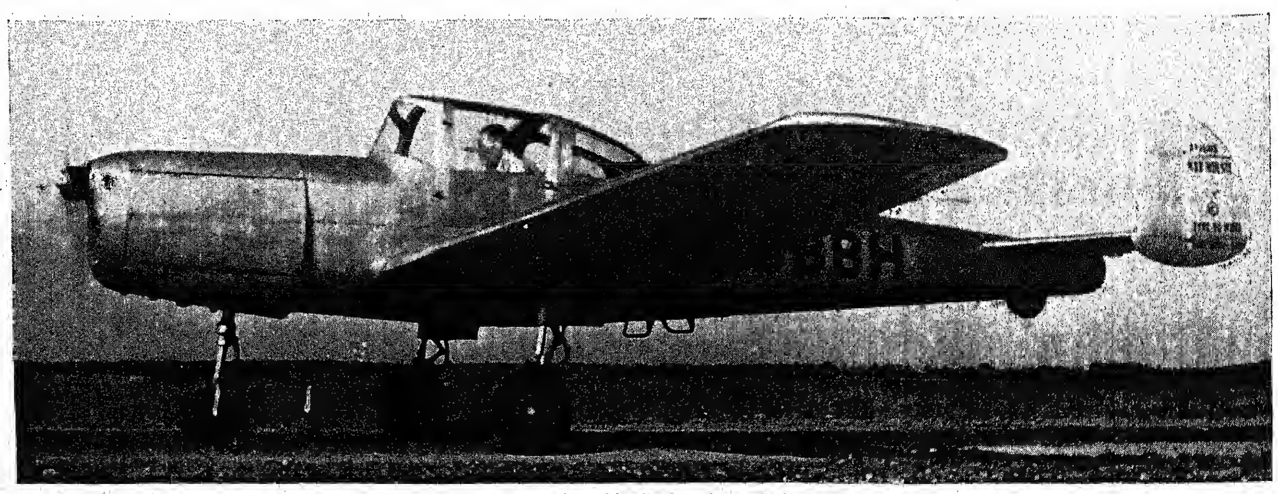
THE MAX HOLSTE M.H. 52.

Type.—Two-seat Touring (M.H. 52) or Training (M.H. 52/E) monoplane.

Wings.—Cantilever low-wing monoplane, comprising two outer wings attached to short stub centre-section integral with fuselage. Structure consists of a central torsion box formed by the spars, to which leading and trailing-edges are attached by Simmonds nuts. Front spar has duralumin flange tapering in thickness, with riveted duralinox web, and is attached to fuselage by eight Simmonds nuts. Rear spar of U-section sheet duralinox is attached to fuselage at one point. Sheet duralinox ribs and longitudinal stiffeners. Stressed duralinox skin applied in two sections (top and bottom) and electrically-welded. Slotted ailerons and trailing-edge flaps of metal construction. Wing area 14 sq. m. (150.5 sq. ft.).

Fuselage.—All metal-monocoque structure of rectangular cross-section at cabin tapering to oval section aft. In three main sections comprising nose-section with engine bearers and nose-wheel mounting; main fuselage (with separate cabin structure) and tail-end, each of which comprises upper and lower components. Transversal members and longitudinal stringers, and stressed metal skin, the whole electrically-welded and riveted.

Tail Unit.—All-metal structure consisting of cantilever tailplane mounting twin fins and rudders as endplates. Tailplane constructed similarly to wing, with Z-section sheet metal front spar and U-section rear spar, and separate leading-edge. Stressed metal skin in two sections joined on median line, electrically welded and



The Max Holste M.H. 52 Two-seat Cabin Monoplane (150 h.p. Potez 4D engine).

MAX HOLSTE—*continued.*

riveted. Mass-balanced elevators of metal construction with fabric covering. Each fin consists of central torsion box formed by two U-section spars, and separate leading-edge. Metal ribs and stringers and stressed metal covering comprising inner and outer sections, autogenously welded. All-metal unbalanced rudders with metal covering.

Landing Gear.—Fixed tricycle type. Main wheels 470 × 175 each carried in half-fork on oleo-pneumatic shock-absorber leg attached to heavy ribs in wing. Free-swivelling non-steerable nose-wheel 355 × 150 carried in fork on autogenously-welded chrome-molybdenum steel-tube mounting. Light metal fairings and spats over all wheels. Hydraulic brakes on main wheels.

Power Plant.—One 150 h.p. Potez 4D six-cylinder in-line air-cooled engine mounted on welded chrome-molybdenum steel-tube bearer and driving Régy two-blade fixed-pitch wooden airscrew. Alternative power units of 95-100 h.p. *e.g.* Régnier, Mathis, Blackburn Cirrus-Minor or Continental engines, may be installed. Fuel capacity 120 litres (26.4 Imp. gallons) in electrically-welded stainless-steel tank in fuselage. Oil tank in front of fireproof bulkhead.

Accommodation.—Enclosed cabin mounted as separate structure above fuselage and seating two side-by-side with dual controls. Plexiglas moulded one-piece windscreen, and side and rear windows. Access door on each side. Dunlopillo padded seats. Baggage compartment aft of seats.

Dimensions.—Span 9.768 m. (32 ft. 1 in.), Length 2.280 m. (23 ft. 10¾ in.), Height 2.172 m. (7 ft. 1½ in.).

Weights and Loadings (150 h.p. Potez 4D engine).—Weight empty 640 kg. (1,411 lbs.), Weight loaded 870 kg. (1,918 lbs.), Wing loading 62 kg./sq. m. (12.7 lbs./sq. ft.), Power loading 5.8 kg./c.v. (12.8 lbs./h.p.).

Weights and Loadings (95-100 h.p. engine).—Weight empty 555 kg. (1,224 lbs.), Pilot and passenger 150 kg. (331 lbs.), Fuel and oil 75 kg. (165 lbs.), Baggage 20 kg. (44 lbs.), Weight loaded 800 kg. (1,764 lbs.), Wing loading 57 kg./sq. m. (11.8 lbs./sq. ft.), Power loading 8 kg./c.v. (17.6 lbs./h.p.).

Performance (150 h.p. Potez 4D engine).—Maximum speed 230 km.h. (143 m.p.h.), Cruising speed 210 km.h. (130 m.p.h.), Landing speed 55 km.h. (34 m.p.h.), Minimum level speed 75 km.h. (47 m.p.h.), Rate of climb at sea-level 270 m./min. (679 ft./min.), Range 600 km. (373 miles).

Performance (95-100 h.p. engine).—Maximum speed 200 km.h. (124 m.p.h.), Cruising speed 180 km.h. (112 m.p.h.), Landing speed 50 km.h. (31 m.p.h.), Range 800 km. (497 miles).

MORANE-SAULNIER.

AÉROPLANES MORANE-SAULNIER.

Head Office: 3, Rue Volta, Puteaux (Seine).

Works: Puteaux (Seine) and Ossun, Near Tarbes (Hautes-Pyrenées).

Commercial Director: M. Sollier.

The Morane-Saulnier Company was originally formed in 1911 and its parasol monoplane fighters were flown by the French Air Force and the Royal Flying Corps in the war of 1914-18. In the inter-war period Morane-Saulnier built many notable aircraft, mainly military trainers and single-seat fighters. The M.S.406 was a standard fighter in the *Armée de l'Air* in 1939 and was in action up to the fall of France.

The Company's present activities include the production of several new all-metal civil monoplanes, including the 75 h.p. M.S. 560 single-seat monoplane; the 140 h.p. M.S. 570, a two-seat enlarged version thereof, and the M.S. 571, a three/four-seater. The M.S. 660 light high-wing monoplane of simplified wooden construction has also been produced for assembly by clubs, etc.

Military designs include the M.S. 470 (720 h.p. Hispano-Suiza 12X engine) which was developed from the M.S. 406 fighter and which served as the prototype of the M.S. 472 fighter-trainer. A contract for 1,000 aircraft of the last-mentioned type has been awarded to the Company. It is in producton at the Ossun-Louey (Hautes-Pyrenées) works. Variations of the M.S. 472 are the M.S. 473 and the M.S. 475, which are identical except for the power-plant.

The M.S. 500 (200 h.p. Renault 6Q engine) is the Morane-built Fieseler Fi 156 Storch communications monoplane, which was last described under "Fieseler" (Germany) in the 1945-46 edition of "All the World's Aircraft." An order for 1,075 of these aircraft was given to Morane-Saulnier, and at the time of writing it was still being produced.

THE MORANE SAULNIER M.S. 472.

Type.—Two-seat Fighter-Trainer.

Wings.—Cantilever low-wing monoplane. Structure in three main sections comprising centre-section and two outer wings. Detachable tips and leading and trailing-edges. All-metal two-spar structure with stressed skin covering. Central box formed by centre-section spars forms main structure and serves also as fuel tank. Centre-section and outer-sections taper in chord and thickness. Incidence 1.5 degrees; dihedral (centre-section) 1.57 degrees; dihedral (outer wings) 7.2 degrees. Centre-section span 2.8 m. (9 ft. 2 in.), Chord 2.105 m. (6 ft. 10¼ in.). Wing area 17.3 sq. m. (186 sq. ft.). All-metal ailerons. Split trailing-edge flaps between ailerons and fuselage, two on each side. Leading-edge slots on prototype (M.S. 470) only.

Fuselage.—All-metal monocoque structure in three main sections comprising two sides and bottom, electrically welded together. Stressed duralumin skin stiffened by vertical members and longitudinal stringers.

Tail Unit.—All-metal cantilever monoplane structure. Variable incidence tailplane controllable in flight. Rudder and elevators statically and aerodynamically-balanced. Controllable trim-tab in rudder. Tailplane span (overall) 4.233 m. (13 ft. 10½ in.), Maximum rudder chord 0.65 m. (2 ft. 1½ in.).

Landing Gear.—Two-wheel retractable type. Wheels carried on shock-absorber struts attached to outer ends of centre-section which retract inwards into fuselage. By a double articulaton wheels remain at right-angles to legs during retraction, and in fully retracted position project slightly below fuselage, affording protection in event of emergency wheel-up landing. Track 3.174 m. (10 ft. 2½ in.). Non-retractable full-swivelling tail-wheel may be linked to rudder-bar for ground control and has centre-lock for take-off and landing.

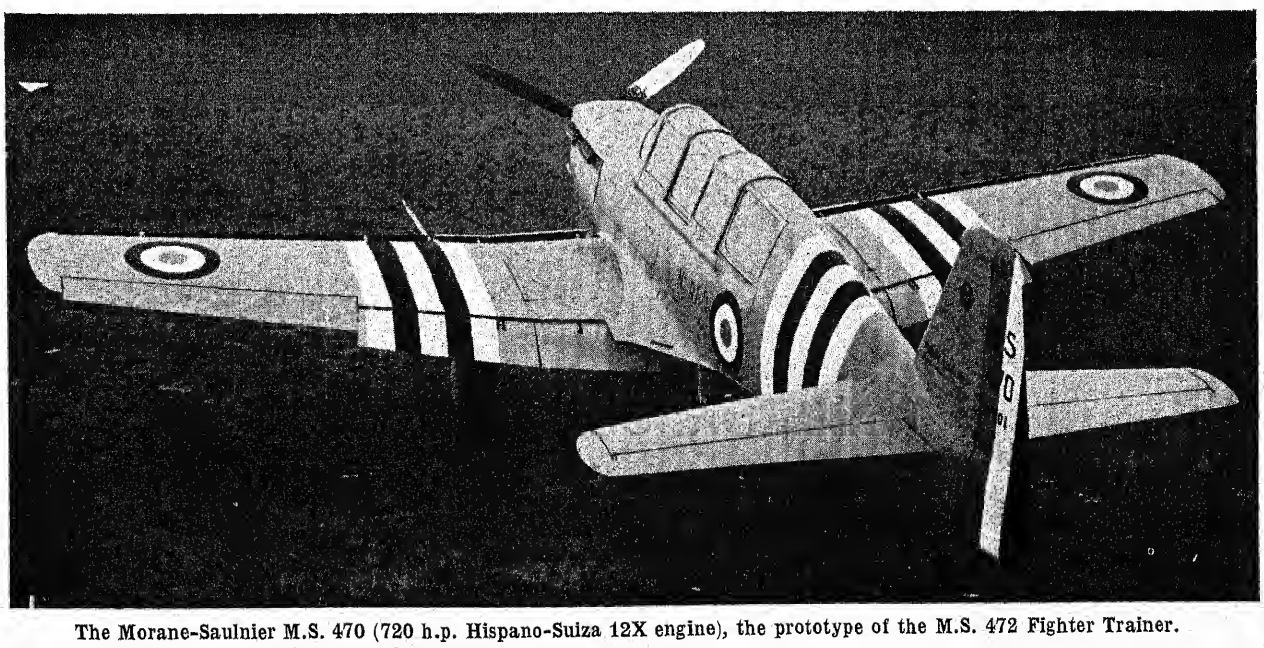
Power Plant.—One 680 h.p. Gnôme Rhône 14M-9 fourteen-cylinder two-row radial air-cooled engine on welded steel-tube ring mounting. Three-blade airscrew 2.7 m. (8 ft. 9 in.) diameter.

Accommodation.—Tandem cockpits for instructor and pupil covered by continuous canopy, two portions of which slide for access. Canopy jettisonable in flight. Full dual controls with adjustable rudder pedals and seats. Full night-flying and radio equipment. Ciné-gun. Locker of 0.4 cub. m. (14.125 cub. ft.) capacity behind rear cockpit.

Armament.—Two 7.5 m/m. machine-guns mounted in wings, with 900 rounds each. Racks for four 35 kg. (77 lb.) bombs and provision for four rocket-projectile launchers.

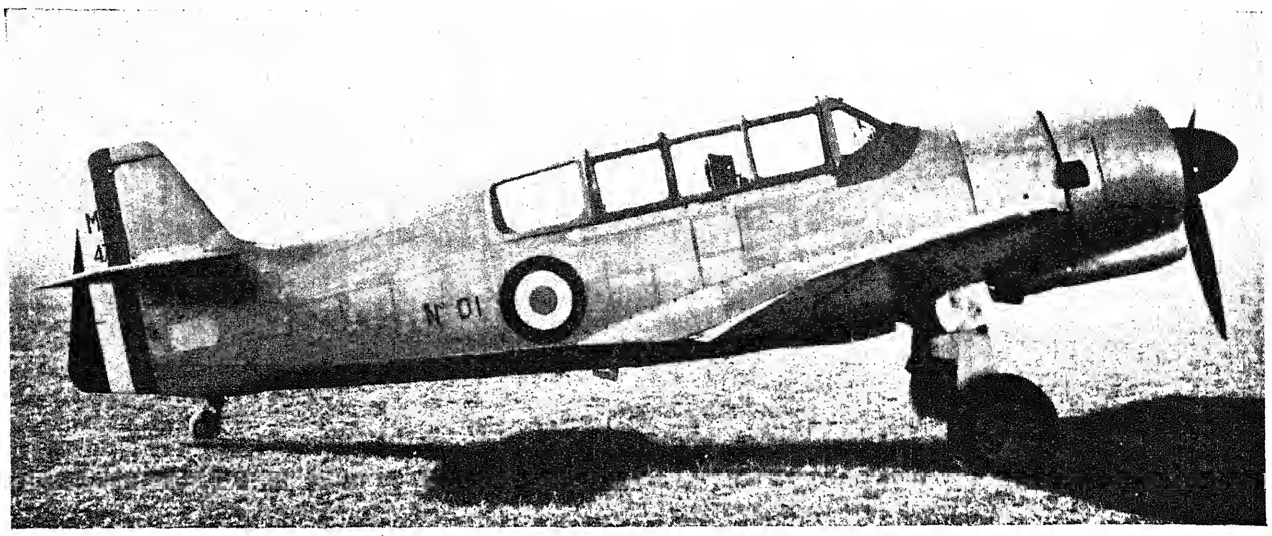
Dimensions.—Span 10.65 m. (34 ft. 11 in.), Length (tail-up) 8.60 m. (28 ft. 3 in.), Height (tail up) 3.619 m. (11 ft. 10¼ in.).

Weights and Loadings.—Weight empty 1,756 kg. (3,817 lbs.), Crew 160 kg. (353 lbs.), Removable equipment 36 kg. (79 lbs.), Fuel and oil 448 kg. (987 lbs.), Total load 644 kg. (1,419 lbs.), Weight loaded 2,400 kg. (5,290 lbs.), Wing loading 139 kg./sq. m.) (28 lbs./sq. ft.), Power loading 3.5 kg./c.v. (7.7 lbs./h.p.).



The Morane-Saulnier M.S. 470 (720 h.p. Hispano-Suiza 12X engine), the prototype of the M.S. 472 Fighter Trainer.

***MORANE-SAULNIER**—continued.*



The Morane-Saulnier M.S. 472 Two-seat Fighter-Trainer (680 h.p. Gnôme-Rhône 14M-9 engine).

PERFORMANCE.—Maximum speed 468 km.h. (290 m.p.h.) at 2,000 m. (6,560 ft.), Climb to 5,000 m. (16,405 ft.) 10 minutes 32 seconds, Still-air range (70% power) 1,530 km. (950 miles) at 2,000 m. (6,560 ft.) at 415 km.h. (258 m.p.h.).

THE MORANE-SAULNIER M.S. 473.

The M.S. 473 is identical to the M.S. 472 but is powered by a Hispano-Suiza 12X 13 twelve-cylinder Vee liquid-cooled engine.

DIMENSIONS.—As M.S. 472 except length, 8.93 m. (29 ft. 3½ in.) .

WEIGHTS AND LOADINGS.—Weight empty 1,780 kg. (3,924 lbs.), Crew 160 kg. (353 lbs.), Removable equipment 36 kg. (79 lbs.), Fuel and oil 448 kg. (987 lbs.), Weight loaded 2,424 kg. (5,343 lbs.). Wing loading 140 kg./sq. m. (28.23 lbs./sq. ft.), Power loading 3.5 kg./c.v. (7.81 lbs./h.p.).

PERFORMANCE.—Maximum speed 470 km.h. (292 m.p.h.) at 2,000 m. (6,560 ft.), Speed at sea level 430 km.h. (267 m.p.h.), Climb to 5,000 m. (16,405 ft.) 11 minutes, Still-air range (70% power) 1,350 km. (840 miles) at 2,000 m. (6,560 ft.) at 420 km.h. (261 m.p.h.).

THE MORANE-SAULNIER M.S. 475.

The M.S. 475 is a further variation of the M.S. 472. It is fitted with a Hispano-Suiza 12Y 45 twelve-cylinder Vee liquid-cooled engine.

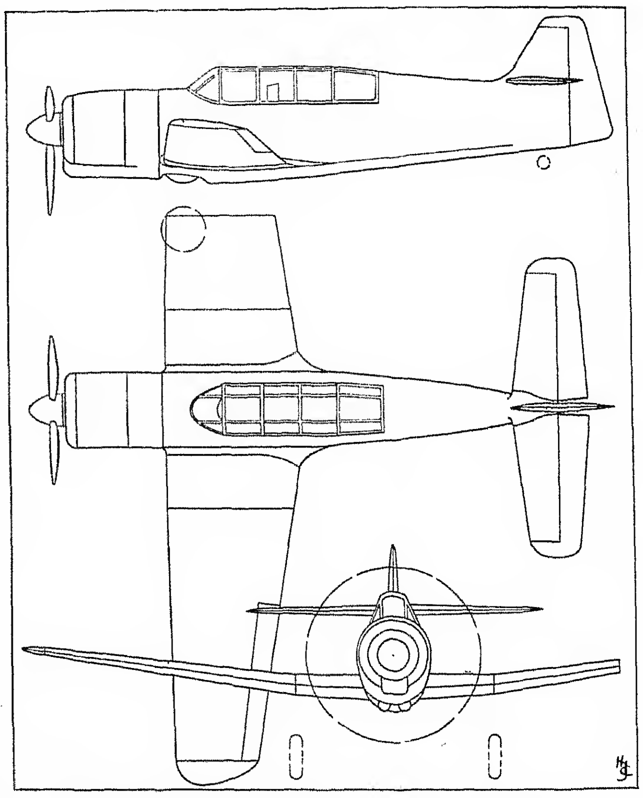
DIMENSIONS.—As M.S. 472 except length, 9 m. (29 ft. 6 in.).

WEIGHTS AND LOADINGS.—Weight empty 1,980 kg. (4,365 lbs.), Crew 160 kg. (353 lbs.), Removable equipment 36 kg. (79 lbs.), Fuel and oil 448 kg. (987 lbs.), Weight loaded 2,624 kg. (5,784 lbs.), Wing loading 152 kg./sq. m. (30.46 lbs./sq. ft.), Power loading 3 kg./c.v. (6.7 lbs./h.p.).

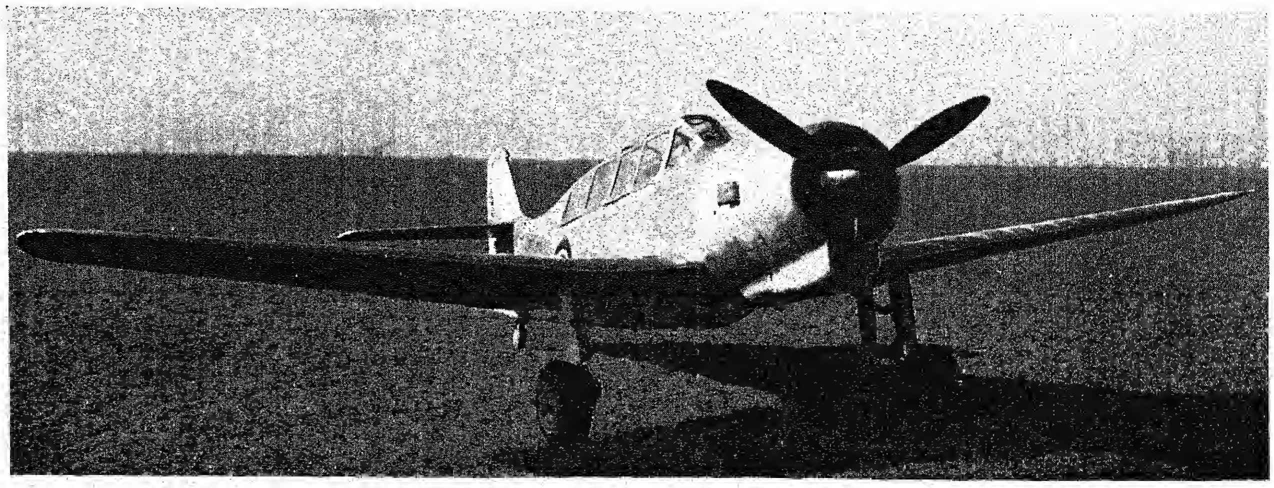
PERFORMANCE.—Maximum speed 550 km.h. (342 m.p.h.) at 5,000 m. (16,405 ft.), Speed at 2,000 m. (6,560 ft.) 500 km.h. (311 m.p.h.), Speed at sea level 460 km.h. (286 m.p.h.), Climb to 5,000 m. (16,405 ft.) 8½ minutes, Still-air range (70% power) 1,200 km. (746 miles) at 2,000 m. (6,560 ft.) at 445 km.h. (276 m.p.h.).

THE MORANE SAULNIER M.S. 502.

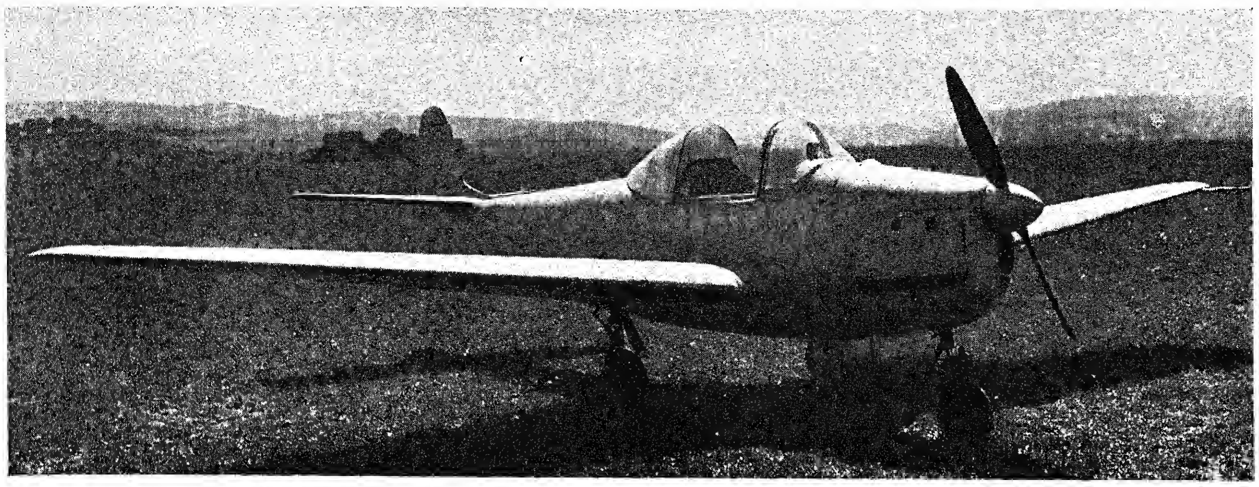
The M.S. 502 is a two-seat liaison, observation and ambulance aircraft developed from the Fieseler Fi 156 Storch which during and since the German Occupation has been built by Morane. It is a strut-braced high-wing monoplane powered by a 230 h.p. Salmson 9 AB nine-cylinder radial air-cooled engine and is fitted with folding wings. In general the MS.502 is similar to the Storch, a full structural description of which appeared in the last issue of this work under "Fieseler" (Germany).



The Morane-Saulnier M.S. 472 Fighter-Trainer.



The Morane-Saulnier M.S. 472 Two-seat Fighter-Trainer (680 h.p. Gnôme-Rhône 14M-9 engine).



The Morane-Saulnier M.S. 560 Single-seat Light Monoplane (75 h.p. Train 6D-01 engine).

Dimensions.—Span 14.25 m. (46 ft. 9 in.), Length 9.65 m. (31 ft. 8 in.), Wing area 26 sq. m. (279.9 sq. ft.).

Weights and Loadings.—Weight empty 965 kg. (2,128 lbs.), Weight loaded 1,424 kg. (3,140 lbs.), Wing loading 54.9 kg./sq. m. (11.23 lbs./sq. ft.), Power loading 6.19 kg./h.p. (13.65 lbs./h.p.).

Performance.—Maximum speed 170 km.h. (105.5 m.p.h.), Cruising speed 140 km.h. (87 m.p.h.), Range 700 km. (435 miles).

THE MORANE-SAULNIER M.S. 560.

Type.—Single-seat Touring and Training Monoplane.

Wings.—All-metal cantilever low-wing monoplane. Wing built in three main sections consisting of centre-section and two outer wings. Detachable tips. Two-spar duralumin structure with stressed metal skin. Central box formed by centre-section spars attached to fuselage at four points and constitutes main structure as well as fuel tank. Detachable leading and trailing-edges. Outer sections attached to ends of centre-section by three bolts each side. Dihedral 7.2 degrees, Centre-section span 2.358 m. (7 ft. 8½ in.), Maximum chord 1.9 m. (6 ft. 3 in.), Gross wing area 11.8 sq. m. (127 sq. ft.). Metal ailerons. Mechanically-operated split trailing-edge flaps in two sections each side; depression 50 degrees.

Fuselage.—All-metal structure built in two longitudinal half shells and joined together with external fillets. Each jig-built half has stressed duralumin skin stiffened internally with trellis members and longitudinal stringers and is electrically flush-welded.

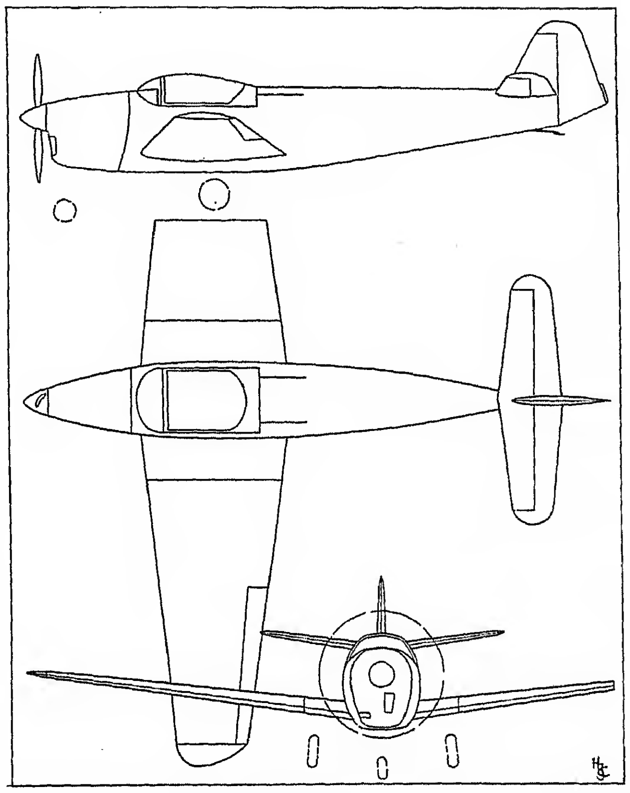
Tail Unit.—All-metal cantilever monoplane type. Fin integral with fuselage. Tailplane dihedral 4.2 degrees. Rudders and elevators statically and aerodynamically-balanced. Trim-tab in rudder adjustable on ground. Tailplane span (overall) 3 m. (9 ft. 9½ in.).

Landing Gear.—Retractable tricycle type. Main wheels carried on shock-absorber legs hinged at extremities of centre-section which retract outwards into wing. Track 1.8 m. (5 ft. 10¾ in.), Wheel-base 1.83 m. (6 ft. 0 in.). Nose-wheel carried in half-fork on shock-absorber leg, retracts backwards into fuselage. Nose-wheel has linkage with rudder-bar for ground control and centre-lock for take-off and landing. Bumper skid under rear fuselage.

Power Plant.—One 75 h.p. Train 6D-01 six-cylinder in-line inverted air-cooled engine, or other similar engine of 65-90 h.p. Two-blade airscrew, 1.8 m. (5 ft. 10¾ in.) diameter. Fuel in compartment formed by centre-section spars. Fuel capacity 93 litres (20 Imp. gallons), Oil capacity 8 litres (1.76 Imp. gallons).

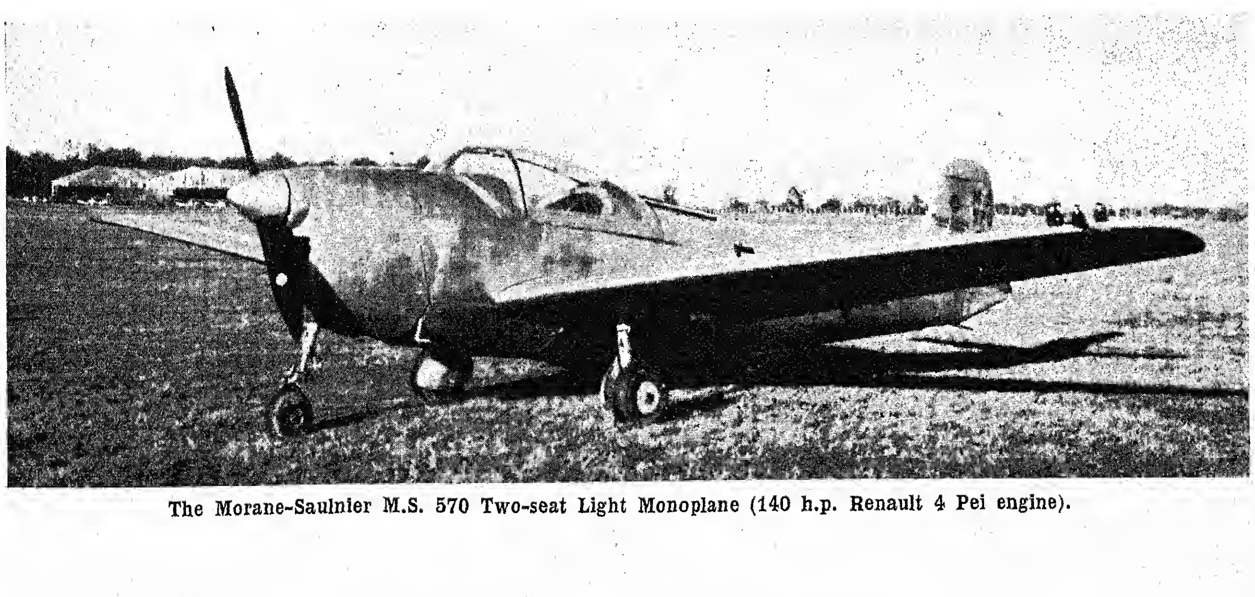
Accommodation.—Pilot's cockpit covered by moulded canopy which slides on three rails for access and can be jettisoned in emergency. Luggage compartment in fuselage aft of cabin.

Dimensions.—Span 8.55 m. (28 ft. 0 in.), Length 7.22 m. (23 ft. 8½ in.), Height (over rudder) 2.0 m. (7 ft. 2½ in.).



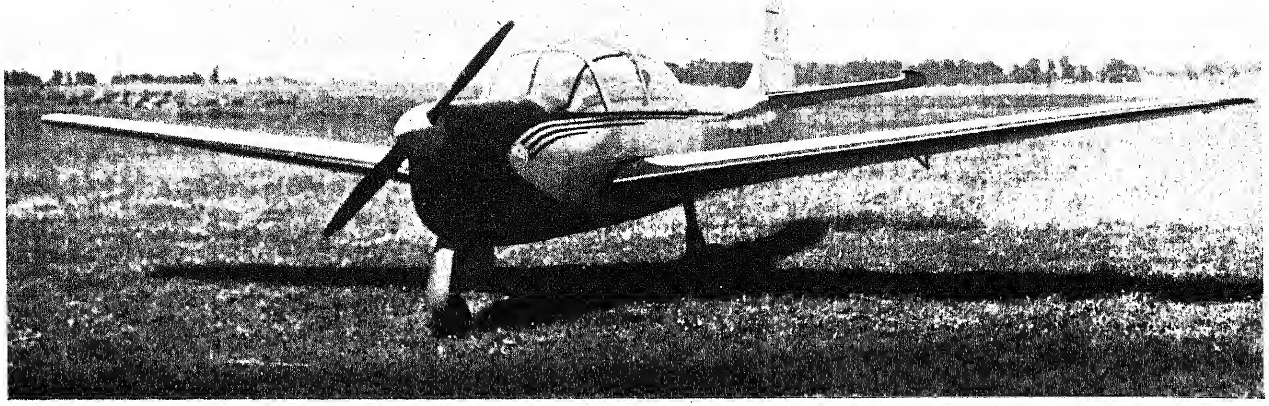
The Morane-Saulnier M.S. 570.

Weights and Loadings.—Weight empty 348 kg. (768 lbs.), Disposable load 187 kg. (412 lbs.), Loaded weight 535 kg. (1,179 lbs.),



The Morane-Saulnier M.S. 570 Two-seat Light Monoplane (140 h.p. Renault 4 Pei engine).

MORANE-SAULNIER—*continued.*



The Morane-Saulnier M.S. 571 Three/Four-seat Cabin Monoplane (140 h.p. Renault 4 Pei engine).

Wing loading 45.3 kg./sq. m. (9.28 lbs./sq. ft.), Power loading 7 kg./h.p. (15.43 lbs./h.p.).

PERFORMANCE.—Maximum speed 234 km.h. (146 m.p.h.) at 500 m. (1,640 ft.). Cruising speed (70% power) 208 km.h. (129 m.p.h.), Landing speed 73 km.h. (45 m.p.h.), Initial climb at sea level 270 m./min. (885 ft./min.) Ceiling 7,000 m. (22,965 ft.), Cruising range 1,000 km. (621 miles).

THE MORANE-SAULNIER M.S. 570.

TYPE.—Two-seat Touring and Training Monoplane.

WINGS.—Structure as M.S. 560. Gross wing area 16.2 sq. m. (174 sq. ft.).

FUSELAGE, TAIL UNIT AND LANDING GEAR.—Structure as M.S. 560.

POWER PLANT.—One 140 h.p. Renault 4 Pei four-cylinder in-line inverted air-cooled engine driving two-blade airscrew. Fuel in compartment formed by centre-section spars. Fuel capacity 160 litres (35 Imp. gallons), Oil capacity 13 litres (2.8 Imp. gallons).

ACCOMMODATION.—Pilot and passenger side-by-side in cockpit covered by moulded canopy which slides on three rails for access and is jettisonable in emergency. Dual controls. Luggage compartment in fuselage aft of cabin.

DIMENSIONS.—Span 10.47 m. (34 ft. 4 in.), Length 8.50 m. (27 ft. 11 in.), Height (over rudder) 2.415 m. (7 ft. 10¾ in.).

WEIGHTS AND LOADINGS.—Weight empty 544 kg. (1,199 lbs.), Disposable load 320 kg. (705 lbs.), Weight loaded 864 kg. (1,905 lbs.), Wing loading 53.5 kg./sq. m. (10.95 lbs./sq. ft.), Power loading 6.2 kg./h.p. (13.66 lbs./h.p.).

PERFORMANCE.—Maximum speed 265 km.h. (165 m.p.h.) at 500 m. (1,640 ft.), Cruising speed (70% power) 235 km.h. (146 m.p.h.), Landing speed (fully loaded) 80 km.h. (50 m.p.h.), Initial rate of climb 324 m./min. (1,065 ft./min.), Ceiling 7,500 m. (24,605 ft.), Cruising range, over 1,000 km. (621 miles).

THE MORANE-SAULNIER M.S. 571.

The M.S. 571 is a three/four-seat version of the M.S. 570. It is structurally similar and is outwardly identical except for an increase in the areas of the fin and rudder. It employs the same type of engine, which drives a two-blade airscrew 2 m. (6 ft. 6½ in.) in diameter. There is capacity for 150 litres (33 Imp. gallons) of fuel and 12 litres (2.6 Imp. gallons) of oil.

A larger cabin is fitted and has accommodation for two side-by-side in front, with a single or double seat behind.

DIMENSIONS.—As M.S. 570 except height (over rudder) 2.785 m. (9 ft. 1 in.).

WEIGHTS AND LOADINGS (Three-seat version).—Weight empty (equipped) 626 kg. (1,380 lbs.), Useful load 398 kg. (877 lbs.), Weight loaded 1,024 kg. (2,257 lbs.), Wing loading 65.43 kg/sq. m. (13.4 lbs./sq. ft.), Power loading 7.29 kg./h.p. (16.1 lbs./h.p.).

WEIGHTS AND LOADINGS (Four-seat version).—Weight empty (equipped) 626 kg. (1,380 lbs.), Useful load 451 kg. (994 lbs.), Weight loaded 1,077 kg. (2,374 lbs.), Wing loading 66.4 kg./sq. m (13.6 lbs./sq. ft.), Power loading 7.65 kg./h.p. (16.9 lbs./h.p.).

PERFORMANCE (Three-seat version).—Maximum speed 245 km.h. (152 m.p.h.) at 500 m. (1,640 ft.). Cruising speed (70% power) 220 km.h. (137 m.p.h.). Landing speed (fully loaded) 80 km.h. (50 m.p.h.). Rate of climb at sea level 228 m./min. (748 ft./min.), Ceiling 5,800 m. (19,630 ft.). Cruising range 880 km. (547 miles).

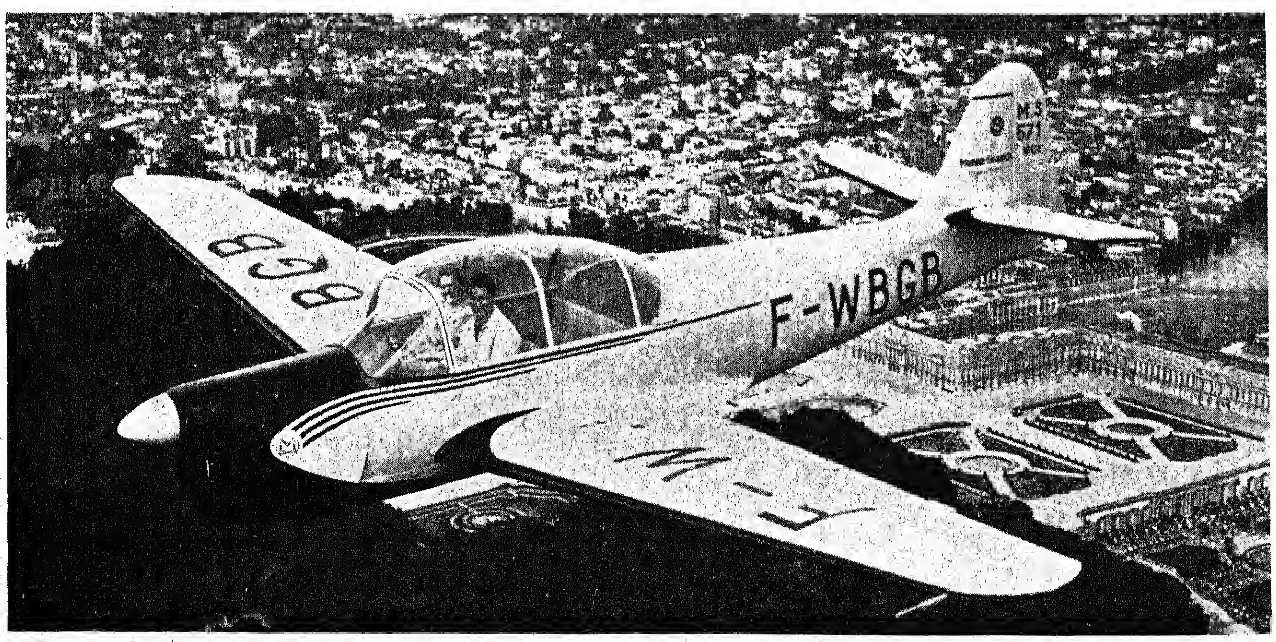
PERFORMANCE (Four-seat version).—Maximum speed 242 km.h. (150 m.p.h.) at 500 m. (1,640 ft.), Cruising speed (70% power) 215 km.h. (134 m.p.h.), Landing speed (fully loaded) 82 km.h. (51 m.p.h.), Rate of climb at sea level 222 m./min. (728 ft./min.), Ceiling 5,700 m. (18,700 ft.), Cruising range 860 km. (534 miles).

THE MORANE-SAULNIER M.S. 660.

TYPE.—Single-seat light monoplane specially designed to be sold in component form.

WINGS.—Strut-braced high-wing monoplane. Constant-chord wing, tapered at roots, in two sections, and braced to fuselage by steel-tube struts. Structure consists of two rectangular-section duralumin spars, built-up fir ribs, steel-tube compression struts and diagonal wire bracing. Formed plywood leading-edge with fabric covering aft. Wooden ply-covered ailerons. Flaps and/or leading-edge slots can be fitted. Wings fold backwards about rear spar and twist to lie with leading-edges downwards. Wing area 9 sq. m. (96.84 sq. ft.).

FUSELAGE.—Wooden rectangular structure in three main sections. Nose, or cockpit section consists of thick plywood sides with cut-outs for doors, and bottom panels, glued and nailed to front and rear bulkwards; sheet panels form top of luggage compartment behind seat and back of cockpit. Fishplates at corners of panels. Welded steel-tube *cabane* to which wings attached. Centre-



The Morane-Saulnier M.S. 571 Three/Four-seat Cabin Monoplane (one 140 h.p. Renault 4 Pei engine).

MORANE-SAULNIER—continued.

fuselage, and rear section with integral fin, constructed of four flat plywood panels glued and nailed to transverse plywood frames.

Tail Unit.—Cantilever monoplane type. Constant-chord tailplane has two spars, fir ribs and plywood covering. Fin, integral with rear fuselage section, consists of flat plywood plate with plywood leading-edge glued on. Horn-balanced rudder. Tailplane span 2.1 m. (6 ft. 10 in.).

Landing Gear.—Fixed tricycle type. Main wheels carried on sprung steel-tube struts. Swivelling nose-wheel, offset 17.5 c/m. (6.8 in.) to starboard, in sprung half-fork. Track 1.55 m. (5 ft. 1 in.), Wheel base 1.47 m. (4 ft. 9½ in.).

Power Plant.—One 50 h.p. Train 4E-01 four-cylinder in-line inverted air-cooled engine mounted on flexible bearers by four bolts and driving two-blade airscrew. Fuel capacity 38 litres (8.36 Imp. gallons), Oil capacity 8 litres (1.76 Imp. gallons).

Accommodation.—Pilot's cockpit under wing, fully enclosed except for door openings. Small luggage shelf aft of seat.

Dimensions.—Span 7.20 m. (23 ft. 6¼ in.), Width folded 2.10 m. (6 ft. 10½ in.), Length 5.60 m. (18 ft. 4½ in.), Height 2.20 m. (7 ft. 2¼ in.).

Weights and Loading.—Weight empty 232 kg. (511 lbs.), Useful load 128 kg. (282 lbs.), Weight loaded 360 kg. (793 lbs.). Wing loading 39.5 kg./sq. m. (8.1 lbs./sq. ft.), Power loading 7.15 kg./h.p. (15.8 lbs./h.p.).

Performance.—Maximum speed 160 km.h. (99 m.p.h.) at sea level, Cruising speed at 50% power 127 km.h. (79 m.p.h.), Landing speed (fully loaded—without flaps) 70 km.h. (43 m.p.h.), Initial rate of climb 240 m./min. (787 ft./min.), Ceiling 4,500 m. (14,765 ft.), Range 500 km. (311 miles), Fuel consumption 7.5 litres/100 km. (2.58 Imp. gallons/100 miles).

NORD.

SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU NORD (S.N.C.A.N.).

Head Office: 20, Rue Vernier, Paris (17e).

Works: Caudebec-en-Caux (Seine-Inf.), Le Havre (Seine-Inf.), Issy-les-Moulineaux (Seine), Les Mureaux (Seine-et-Oise), Méaulte (Seine-et-Oise), Sartrouville (Seine-et-Oise) and Courbevoie (Seine).

President Director-General: M. Pissavy.
Technical Director: M. Louis Coroller.
Director of Production: M. Vellutini.
Commercial Director: M. Leconte.

The Société Nationale de Constructions Aéronautiques du Nord was formed in 1937 under the laws for the nationalisation of the Aircraft Industry. It grouped together the former Potez, C.A.M.S. and Les Mureaux companies and also took over certain factories belonging to the Amiot and Breguet concerns. M. Henry Potez was the first Administrator. At the end of 1945 the Société Anonyme des Avions Caudron-Renault was incorporated in the S.N.C.A.N.

Since the liberation of France the S.N.C.A.N. has produced the Nord 1101 Noralpha, a four-seat cabin monoplane, and the Nord 1201 Norécrin, a three-seat light touring monoplane. The latter was classed first in the competition organized in the Spring of 1946 by the Air Minister to select the touring aeroplane possessing the best all-round qualities.

In addition, the S.N.C.A.N. has under development the Nord 1400, Nord 1500 torpedo/dive-bomber and the Nord 1600, an experimental jet-propelled aircraft of which it is not yet possible to give details. S.N.C.A.N. is also producing the Stampe & Vertongen S.V.4C training biplane, a Renault-powered version of the S.V.4B described under "Stampe & Vertongen" (Belgium).

THE NORD 1101 NORALPHA.

Type.—Four-seat Cabin monoplane.

Wings.—Cantilever Low-wing monoplane. Short centre-section integral with the fuselage and two tapering outer sections with rounded tips. Single-spar metal structure. Flaps between ailerons and fuselage. Wing area 17.40 sq. m. (187 sq. ft.).

Fuselage.—All-metal structure.

Tail Unit.—Cantilever monoplane type. All-metal framework with metal-covered fin and tailplane and fabric-covered rudder and elevators.

Landing Gear.—Retractable tricycle type. Main wheels raised inwards and nose wheel backwards. Hydraulic retraction.

Power Plant.—One Renault 6Q10 six-cylinder in-line inverted air-cooled engine rated at 240 C.V. at 2,500 r.p.m. Two-blade Ratier electrically-operated variable-pitch airscrew. The whole engine unit is attached to the fireproof bulkhead at four points and is readily removable. Four fuel tanks, two (70 litres each) in the centre-section and two (60 litres each) in the outer wings. Total fuel capacity 260 litres (57.2 gallons).

Accommodation.—Enclosed cabin seating four in two pairs, the front pair of seats with dual controls. Baggage compartment aft of cabin. Collapsible ladder for access to cabin is stowed in baggage compartment. Cabin door has quick-release hinges for emergency exit. Full instrument and electrical equipment.

Dimensions.—Span 11.50 m. (37 ft. 8 in.), Length overall 8.845 m. (28 ft. 0 in.), Height overall 3.350 m. (10 ft. 8 in.).

Weights.—Weight empty 945 kg. (2,080 lbs.), Fuel and oil 205 kg. (450 lbs.), Disposable load 634 kg. (1,395 lbs.), Weight loaded 1,580 kg. (3,476 lbs.).

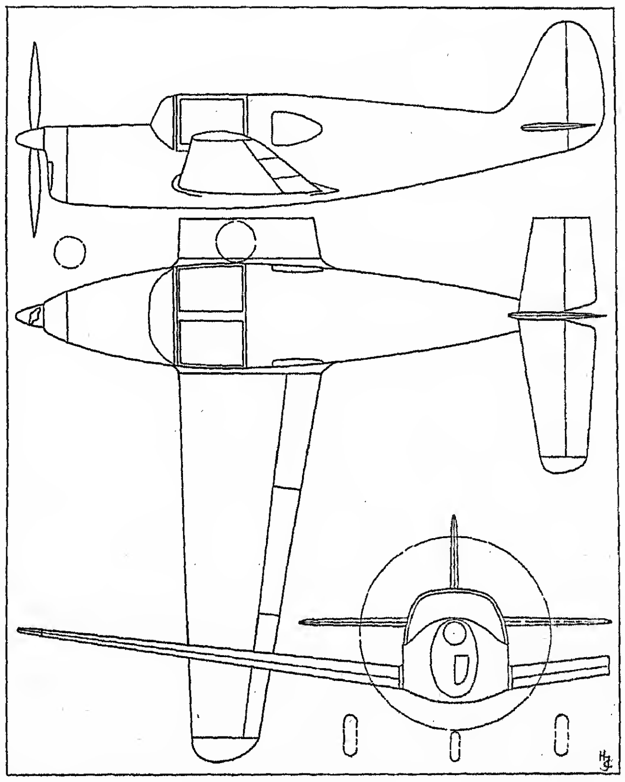
Performance.—Maximum speed 305 km.h. (189.4 m.p.h.), Cruising speed 277 km.h. (172 m.p.h.), Landing speed 100 km.h. (62.1 m.p.h.), Service ceiling 5,900 m. (19,350 ft.), Cruising range (no wind) 1,200 km. (745 miles) at 277 km.h. (172 m.p.h.).

THE NORD 1201 NORÉCRIN.

Type.—Three-seat light Touring Monoplane.

Wings.—Low-wing cantilever monoplane. Tapering wings with acute dihedral attached to roots incorporated in the fuselage structure. Single spar metal wing structure. Wing flaps between ailerons and fuselage. Wing area 13 sq. m. (140 sq. ft.).

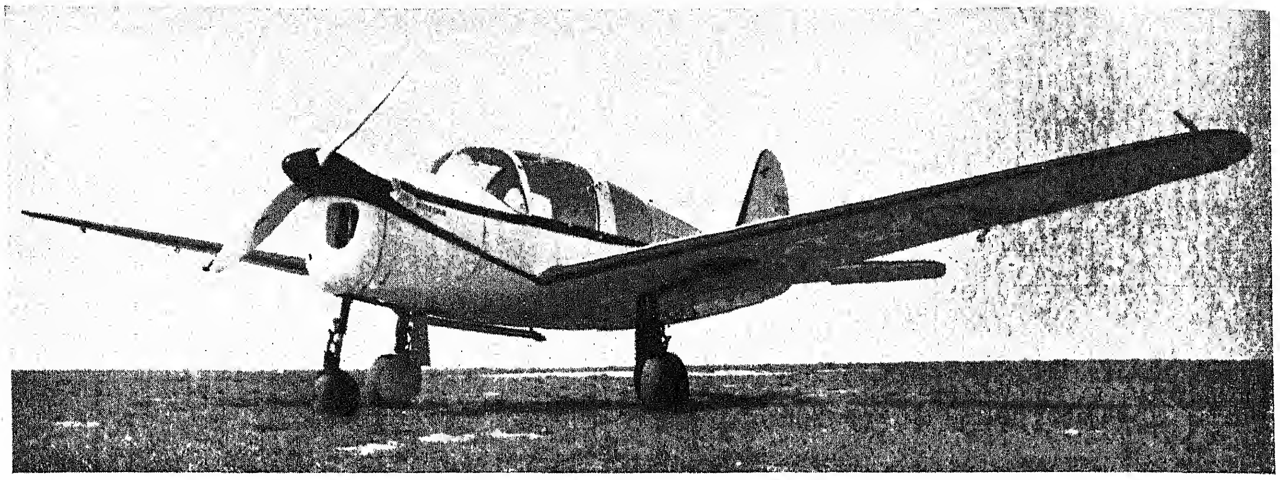
Fuselage.—All metal structure.



The Nord 1201 Norécrin.

The Nord 1101 Noralpha Four-seat Cabin Monoplane (240 h.p. Renault 6Q10 engine).

***NORD**—continued.*



The Nord 1201 Norécrin Three-seat Touring Monoplane (140 h.p. Renault 4 Pei engine).

Tail Unit.—Cantilever monoplane type. Fin integral with fuselage. All-metal tailplane. Movable surfaces have metal frames and fabric covering.

Landing Gear.—Retractable tricycle type. Main wheels retract outwardly, nose wheel backwards. Mechanical retraction.

Power Plant.—Ono Renault 4Pei four-cylinder in-line inverted air-cooled engine rated at 140 h.p. at 2,400 r.p.m. Prototype fitted with two-blade fixed-pitch wooden airscrew. Two fuel tanks in wings. Total fuel capacity 120 litres (26.4 Imp. gallons).

Accommodation.—Enclosed cabin seating three, two side-by-side with dual controls and one at the back of the cabin. Space for light hand baggage provided on each side of the third seat. Moulded plastic windshield and side panels. Jettisonable door for emergency exit.

Dimensions.—Span 10.2 m. (33 ft. 5½ in.), Overall length 6.850 m. (22 ft. 6½ ins.), Overall height 2.76 m. (9½ ft.).

Weights.—Weight empty 538 kg. (1,184 lbs.), Fuel and oil 93 kg. (205 lbs.), Disposable load 243 kg. (535 lbs.), Weight loaded 875 kg. (1,925 lbs.).

Performance.—Maximum speed 265 km.h. (164.5 m.p.h.), Cruising speed 230 km.h. (143 m.p.h.), Cruising range in still air 900 km. (560 miles), Take-off run 160 m. (175 yards).

THE NORD 1500 NORÉCLAIR.

Type.—Twin-engined Naval Reconnaissance Bomber.

Wings.—Cantilever shoulder-wing monoplane. All-metal single-spar structure with gull-wing centre-section, and stressed metal skin. Outer wing sections fold rearwards about spar ; hydraulic operation. All-metal ailerons with trim-tab in each on outer wings, and slotted trailing-edge flaps between ailerons and fuselage divided by nacelles. Wing area 46 sq. m. (495 sq. ft.).

Fuselage.—All-metal monocoque structure.

Tail Unit.—Cantilever monoplane type. Metal structure with metal-covered fin and tailplane and fabric-covered rudder and elevators. Statically-balanced control surfaces with trim-tab in each.

Landing Gear.—Retractable two-wheel type. Main wheels 1,180 × 425 carried on shock-absorber legs retract rearwards into engine nacelles and are fully enclosed. Hydraulic operation. Track 5.35 m. (17 ft. 6¼ in.). Tail-wheel 560 × 236 retracts rearwards into fuselage.

Power Plant.—Two Gnôme-Rhône 14 R25 fourteen-cylinder two-row radial air-cooled engines each developing a maximum output of 1,600 h.p. at 2,600 r.p.m. for take-off, enclosed in tapered long-chord cowling and driving Ratier three-blade variable-pitch airscrew, 3.60 m. (11 ft. 9¾ in.) diameter.

Accommodiaton.—Crew of three. Pilot's cockpit forward and enclosed dorsal position for gunner.

Armament.—Twin machine-guns in rear cockpit, to be replaced on later aircraft by two 20 m/m. (0.79 in.) cannons. Fuselage bomb-bay accommodates bombs or torpedoes.

Dimensions.—Span 19.70 m. (64 ft. 7½ in.), Length 14.25 m. (46 ft. 9 in.), Height 6.54 m. (21 ft. 5½ in.).

Weights and Loadings (Designed).—Weight empty 7,100 kg. (15,652 lbs.), Fuel and oil 1,220 kg. (2,690 lbs.), Disposable load 2,480 kg. (5,468 lbs.), Weight loaded 10,800 kg. (23,810 lbs.), Wing loading 234.8 kg./sq. m. (48 lbs./sq. ft.), Power loading 3.37 kg./h.p. (7.43 lbs./h.p.).

Performance.—Maximum speed 540 km.h. (336 m.p.h.) at 3,000 m. (9,840 ft.), Cruising speed 400 km.h. (249 m.p.h.), Landing speed 144 km.h. (89 m.p.h.), Ceiling 10,000 m. (32,810 ft.), Still-air range 3,450 km. (2,144 miles), Take-off run 250 m. (273 yds.), Landing run 169 m. (185 ft.).

THE NORD 1400 NOROIT.

The Nord 1400 is a projected twin-engined flying-boat to be powered by two 1,675 h.p. Gnôme-Rhône 14 R 25 fourteen-cylinder two-row radial air-cooled engines and to carry a crew of seven. No further particulars apart from the following figures were available for publication at the time of writing.

Dimensions.—Span 31.60 m. (103 ft. 8 in.), Wing area 100 sq. m. (1,076 sq. ft.).

Weight and Loadings (Designed).—Weight loaded 17,010 kg. (37,482 lbs.), Wing loading 170.1 kg./sq. m. (34.8 lbs./sq. ft.), Power loading 5 kg./h.p. (11 lbs./h.p.).

Performance (Estimated).—Maximum speed 350 km.h. (216 m.p.h.), Range 3,000 miles (1,864 miles).

THE NORD-CAUDRON C.800 ÉPERVIER (SPARROWHAWK).

The C.800 is a two-seat sailplane intended for advanced training purposes, and 300 have been ordered by the French Government to equip the National Gliding Centres. It is a strut-braced high-wing monoplane with a wooden single-spar wing which has a stressed plywood leading-edge and fabric covering aft. The fuselage is a wooden monocoque structure, and the tail-unit is a cantilever monoplane structure with ply-covered fin and tailplane and fabric-covered control surfaces.

The crew of two is accommodated side-by-side in an enclosed cockpit.

The Nord 1500 Noréclair Naval Reconnaissance Bomber (Two Gnôme-Rhône 14 R25 engines).—(*The Aeroplane*).

NORD—*continued.*

Dimensions.—Span 16.005 m. (52 ft. 6 in.), Length 8.355 m. (27 ft. 5½ in.), Height 2.365 m. (7 ft. 8½ in.), Wing area 22 sq. m. (236.7 sq. ft.), Aspect ratio 11.6.
Weights and Loadings.—Weight empty 229 kg. (505 lbs.), Normal weight loaded 389 kg. (858 lbs.), Maximum weight loaded 440 kg. (970 lbs.), Wing loading (normal) 17.6 kg./sq. m. (3.6 lbs./sq. ft.).
Performance.—Maximum speed 72 km.h. (45 m.p.h.), Cruising speed 62 km.h. (38.5 m.p.h.), Sinking speed 0.85 m./second (2.78 ft./second).

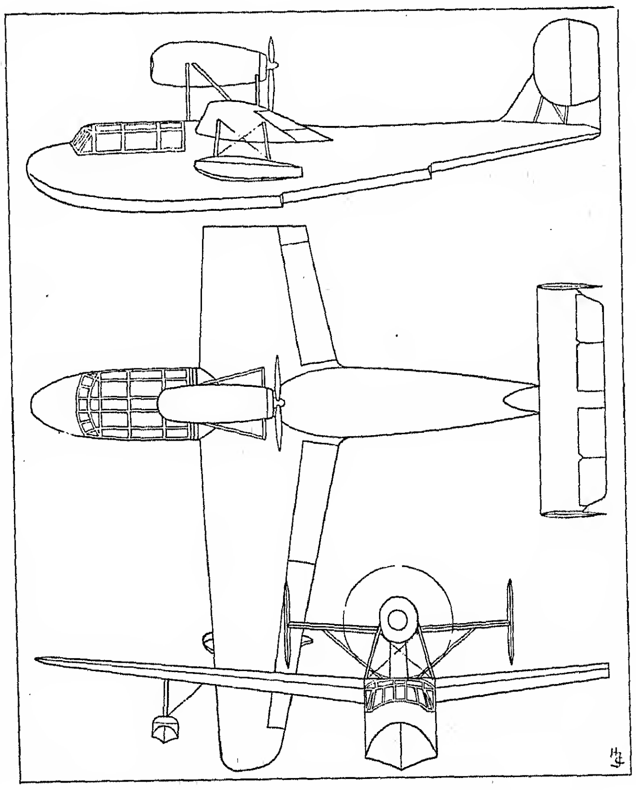
S.C.A.N.

SOCIÉTÉ DE CONSTRUCTIONS AÉRO NAVALES DU PORT BEUF.

This Company has produced the S.C.A.N.20 flying-boat, an order for thirty of which was given by the French Air Ministry for instructing pilots in the handling of flying-boats. The S.C.A.N.20 was designed and built in secret in 1941, and flight tests were effected immediately following the liberation.

THE S.C.A.N.20

Type.—Single-engined Training Flying-boat.
Wings.—Cantilever high-wing monoplane constructed in one piece and bolted to top of hull. Two-spar structure, with chordwise ribs, spanwise stringers and stressed skin covering. Hinged trailing-edge, outer portions acting as ailerons and inner portions as flaps Flap depression 28 degrees; electric operation. Wing area 32 sq. m. (344 sq. ft.).
Hull.—Two-step structure, with ash keel. Outboard floats suspended under wing by tubular struts and wire-braced. Draught of hull (empty) 0.545 m. (1 ft. 9½ in.).
Tail Unit.—Strut-braced dihedral tailplane mounted on central fin and carrying twin fins and rudders at extremities. Rudders and elevators aerodynamically-balanced and fabric-covered.
Power Plant.—One 325 h.p. Béarn 6-D six-cylinder in-line or one Potez 8-D eight-cylinder vee air-cooled engine mounted as pusher unit above hull on two pairs of tubular N-struts, and driving Ratier three-blade variable-pitch propeller.
Accommodation.—Two pilots side-by-side in cabin with dual control, and two seats immediately behind. Baggage compartment in nose.
Dimensions.—Span 15 m. (49 ft. 2½ in.), Length 11.79 m. (38 ft. 6 in.), Height 3.62 m. (11 ft. 10½ in.).
Weight and Loading.—Maximum weight loaded 2,500 kg. (5,511 lbs.), Wing loading 78.1 kg./sq. m. (16 lbs./sq. ft.).
Performance.—Maximum speed 230 km.h. (143 m.p.h.) at 2,000 m. (6,560 ft.), Cruising speed 200 km.h. (124 m.p.h.), Alighting speed 80 km.h. (50 m.p.h.), Ceiling 5,000 m. (16,405 ft.), Range 1,000 km. (621 miles).



The S.C.A.N. 20 Flying-boat.

S.E.C.A.N.

SOCIÉTÉ D'ETUDES ET DE CONSTRUCTIONS AÉRO-NAVALES.

Office and Works: 40, Rue Henri Barbusse, Gennevilliers (Seine).

Director-General: M. Vinsonneau.

The Société d'Etudes et de Constructions Aéro-Navales is a branch of the Usines Chausson, a company well-known in the French automobile industry, and has specialised until recently in the production of certain aircraft accessories.

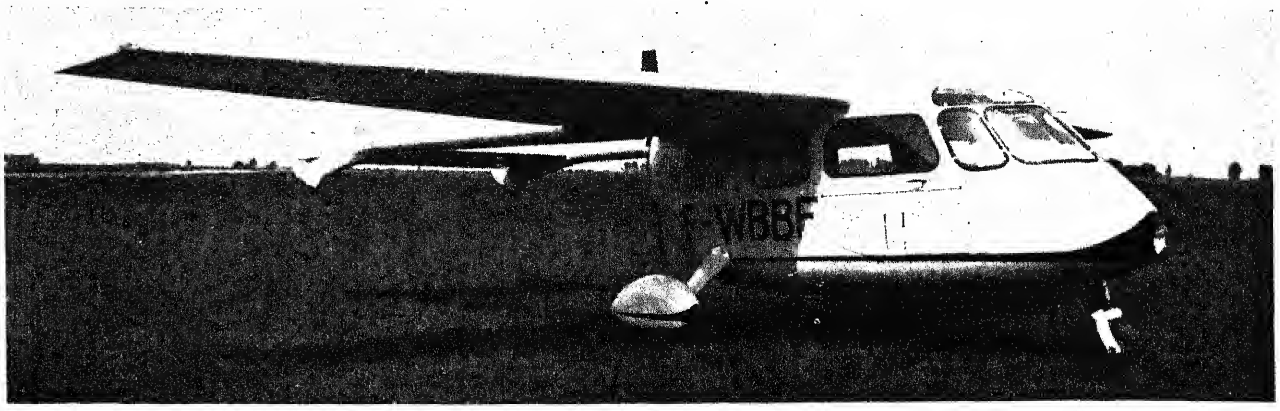
Since the war the company has undertaken the manufacture of all-metal light aircraft, the first example of which is the type S.U.C. 10 Courlis, a four-seat cabin monoplane with pusher airscrew and the tail carried by twin booms.

THE S.E.C.A.N. TYPE S.U.C. 10 COURLIS (CURLEW).

Type.—Four-seat Light Cabin monoplane.
Wings.—High-wing cantilever monoplane. Rectangular centre-section integral with the cabin and two tapering outer-sections. Aluminium-alloy structure built up of two spars, inter-spar former ribs, D-section leading-edge and a stressed-skin covering between the spars supported by spanwise stringers. Entire trailing-edge of outer wings hinged, the inner sections as slotted flaps and the outer sections as ailerons. Wing area 19.10 sq. m. (205.5 sq. ft.).
Fuselage.—Short fuselage of all-metal construction, the main structural members being a bulkhead to which the engine bearers are attached and a girder structure which forms the floor of the cabin and supports the cabin superstructure.
Tail Unit.—Monoplane type. Tailplane supported between twin tubular booms and integral fins. All-metal structure.
Landing Gear.—Fixed tricycle type. Main wheels carried by single faired legs which are hinged near their upper ends to the lower edges of the fuselage. The extensions of the legs within the fuselage are attached to transverse oleo shock-absorber struts. Steerable nose wheel under the nose of the fuselage. Pneumatic brakes on main wheels.
Power Plant.—One Mathis G8R eight-cylinder inverted Vee air-cooled engine rated at 190 C.V. and with 200 C.V. available for take-off, or one Renault 6Q10 six-cylinder in-line inverted air-cooled engine rated at 220 C.V. and with 240 C.V. available for take-off. Engine mounted as a pusher at rear end of the fuselage and driving a two-blade fixed-pitch wood pusher propeller. Fuel

The S.E.C.A.N. Type S.U.C. 10 Courlis Four-seat Cabin Monoplane (200 h.p. Mathis G8R engine).

***S.E.C.A.N.**—continued.*



The S.E.C.A.N. Type S.U.C. 10 Courlis Four-seat Cabin Monoplane (Mathis G8R engine).

tanks in centre-section between fuselage and tail booms. Total fuel capacity 200 litres (44 Imp. gallons). Electric inertia starter.

ACCOMMODATION.—Enclosed cabin in forward portion of fuselage normally seating four in two pairs, the front pair with dual controls. Various other internal arrangements are possible, including the fitting of two cross benches aft of pilot to seat five passengers, provision for carriage of two stretchers together with pilot and medical attendant, and removal of all passenger seats for the carriage of freight. Entrance to cabin on starboard side. Wide rectangular doors on horizontal hinges open upwards and downwards to give access to both front and rear seats and to permit loading of stretchers or bulky freight. Lower door rests on ground when open and hinged step provided on inside of door. Sound-proofing and air-conditioning. Blind and night-flying equipment, radio, etc.

DIMENSIONS.—Span 11.5 m. (37 ft. 8 in.), Length 8.18 m. (26 ft. 10 in.), Height 2,677 m. (8 ft. 9½ in.).

WEIGHTS (200 h.p. Mathis G8R engine).—Weight empty 895 kg. (1,970 lbs.) four passengers and baggage 340 kg. (750 lbs.), Fuel and oil 204 kg. (450 lbs.), Total disposable load 544 kg. (1,200 lbs.), Weight loaded 1,439 kg. (3,170 lbs.).

PERFORMANCE. (200 h.p. Mathis G8R engine)—Maximum speed 250 km.h. (155.2 m.p.h.), Cruising speed (70% output) 220 km.h. (136.6 m.p.h.), Landing speed 80 km.h (50 m.p.h.), Cruising range (4 passengers and baggage) 1,230 km. (765 miles), Service ceiling 5,000 m. (16,400 ft.).

S.E.C.A.T.

SOCIÉTÉ D'ETUDES ET DE CONSTRUCTION D'AVIONS DE TOURISME.

This Company was formed in 1938 and produces the RG-60 single-seat light biplane, and the RG-75 and S-5 two-seat cabin monoplanes, descriptions of which follow.

S.E.C.A.T. will also produce the L.D.45 single-seat light biplane, particulars of which will be found under "M.D.G."

THE S.E.C.A.T. RG-75.

TYPE.—Two-seat Cabin Monoplane.

WINGS.—Cantilever high-wing monoplane. Wooden single-spar structure of trapezoidal plan form with swept-forward centre-section attached to fuselage by six steel bolts. False spar carries ailerons. Stressed okoumé-and-birch plywood covering. Root chord 2.0 m. (6 ft. 6¾ in.), tip chord 1.0 m. (3 ft. 3¼ in.); thickness at root 30 c/m. (11.8 in.); thickness at tip 12 c/m. (4.7 in.); gross wing area 14 sq. m. (150.64 sq. ft.); long-span slotted ailerons arranged to operate also as flaps. Aileron span 3.70 m. (12 ft. 1 in.); aileron chord 30 c/m. (11.8 in.).

FUSELAGE.—Wooden structure of longerons, transversal frames and spruce longitudinal stringers, with birch plywood covering. Maximum width 1.25 m. (4 ft. 1 in.); maximum depth 1.30 m. (4 ft. 4 in.).

TAIL UNIT.—Cantilever monoplane type. Spruce framework with okoumé plywood covering over all surfaces. Adjustable tailplane attached to top longerons. Horn-balanced rudder and elevators. Tailplane span 3.0 m. (9 ft. 9½ in.).

LANDING GEAR.—Fixed two-wheel divided type. Each unit consists of autogenously-welded steel-tube structure, with Neumann spring shock-absorber leg hinged to lower longerons and half-axles attached to bottom of fuselage. Wheels 550 × 150, with mechanically-operated brakes. Tail-wheel carried in fork on spring leg.

POWER PLANT.—One 70 h.p. Régnier 4-D.2 four-cylinder in-line inverted air-cooled engine mounted on triangulated chrome-molybdenum steel-tube bearer and driving Merville two-blade wooden airscrew. Fuel tank of 70 litres (15.4 Imp. gallons) capacity above luggage locker aft of cabin.

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Seats designed to take seat or back-type parachutes. Moulded windscreen, roof windows and side panels. Access door on each side. Luggage locker aft of cabin.

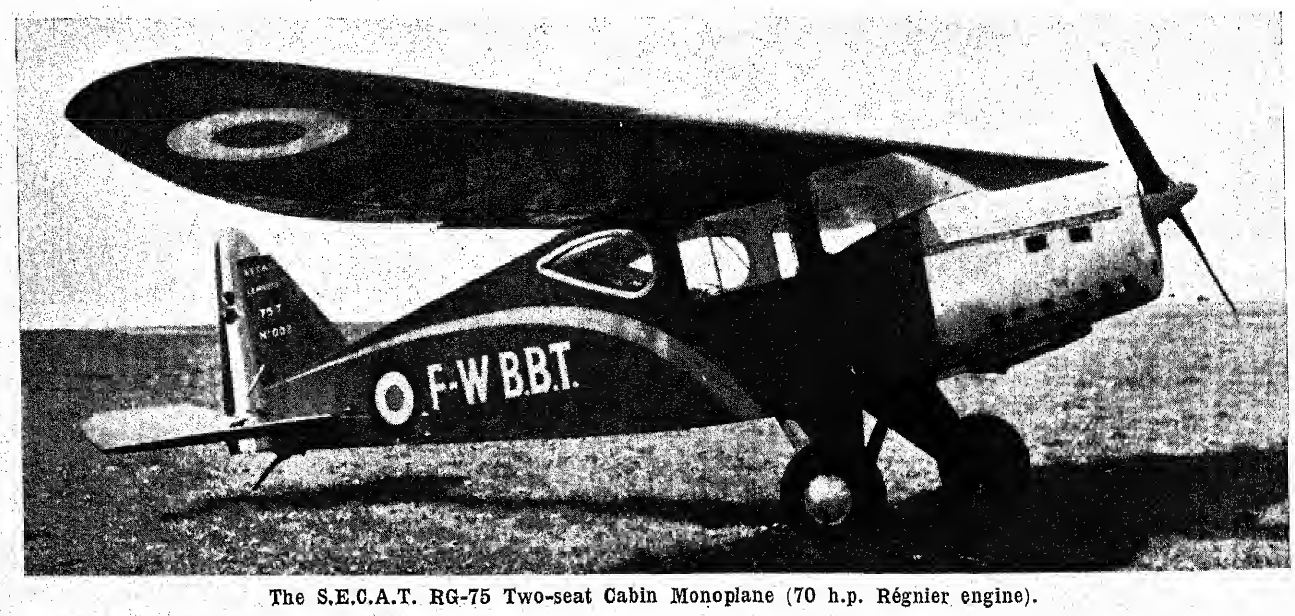
DIMENSIONS.—Span 10.0 m. (32 ft. 9¼ in.), Length 7.0 m. (23 ft.), Height 1.90 m. (6 ft. 3 in.).

WEIGHTS AND LOADINGS.—Weight empty 280 kg. (617 lbs.), Disposable load 220 kg. (485 lbs.), Weight loaded 500 kg. (1,102 lbs.), Wing loading 35 kg./sq. m. (7.16 lbs./sq. ft.), Power loading 7 kg./h.p. (15.4 lbs./h.p.).

PERFORMANCE.—Maximum speed 180 km.h. (112 m.p.h.), Cruising speed 170 km.h. (106 m.p.h.), Landing speed 50 km.h. (31 m.p.h.), Initial rate of climb 210 m./min. (639 ft./min.), Service ceiling 5,000 m. (16,405 ft.), Maximum range 800 km. (497 miles), Take-off run 100 m. (109 yds.), Fuel consumption 13 litres (2.8 Imp. gallons) per hour, Oil consumption 400 gr. (0.08 Imp. gallons) per hour.

THE S.E.C.A.T. RG-60.

The RG-60 is a single-seat open-cockpit light biplane, the lower wing being of smaller span and chord, with a cantilever monoplane tail-unit and a fixed two-wheel landing gear. It is of all-wood construction and is powered by a 40 h.p. Train four-cylinder in-line inverted air-cooled engine driving a Merville two-blade fixed-pitch airscrew. The fuel tank of 45 litres (9.9 Imp. gallons) capacity is in the fuselage.



The S.E.C.A.T. RG-75 Two-seat Cabin Monoplane (70 h.p. Régnier engine).

S.E.C.A.T.—*continued.*

Dimensions.—Span (upper) 5 m. (15 ft. 4¾ in.), Span (lower) 4.50 m. (14 ft. 9 in.), Length 4.95 m. (16 ft. 3 in.), Height 1.90 m. (6 ft. 3 in.), Wing area 9.50 sq. m. (102.22 sq. ft.).

Weights and Loadings (Designed).—Weight empty 180 kg. (397 lbs.), Disposable load 115 kg. (253 lbs.), Weight loaded 295 kg. (650 lbs.), Wing loading 32.8 kg./sq. m. (6.7 lbs./sq. ft.), Power loading 4.45 kg./CV (9.9 lbs./h.p.).

Performance (Estimated).—Maximum speed 190 km.h. (118 m.p.h.), Cruising speed 175 km.h. (109 m.p.h.), Landing speed 45 km.h. (28 m.p.h.), Ceiling 5,000 m. (16,405 ft.), Range 500 km. (311 miles), Take-off run 40 m. (44 yds.).

THE S.E.C.A.T. S-5.

The S-5 is a development of the S-4 Mouette two-seat high-wing cantilever monoplane of 1938, and is powered by a 75 h.p. Régnier 4-D.2 four-cylinder in-line inverted air-cooled engine driving a two-blade fixed-pitch airscrew. A fuel tank of 55 litres (12.1 Imp. gallons) capacity is installed in the wing.

The wing is of elliptical plan form and is composed of a wooden box spar, chordwise ribs and a stressed plywood skin. Ailerons and flaps are fitted to the trailing-edge. The fuselage is a wooden monocoque structure, and the tail-unit is of the cantilever monoplane type. A fixed two-wheel landing-gear is fitted.

The pilot and passenger are accommodated side-by-sido in an enclosed cabin, with an access door on each side.

Dimensions.—Span 9.0 m. (29 ft. 6¼ in.), Length 6.15 m. (20 ft. 2 in.), Height 2.10 m. (6 ft. 10¾ in.), Wing area 14 sq. m. (150.64 sq. ft.).

Weights and Loadings.—Weight empty 350 kg. (772 lbs.), Disposable load 220 kg. (485 lbs.), Weight loaded 570 kg. (1,257 lbs.), Wing loading 41 kg./sq. m. (8.4 lbs./sq. ft.), Power loading 7.6 kg./CV (17 lbs./h.p.).

Performance.—Maximum speed 180 km.h. (122 m.p.h.), Cruising speed 150 km.h. (93 m.p.h.), Landing speed 50 km.h. (31 m.p.h.), Initial rate of climb 180 m./min. (590 ft./min.), Ceiling 3,600 m. (11,810 ft.), Range 800 km. (497 miles), Fuel consumption 15 litres (3.3 Imp. gallons) per hour.

S.I.P.A.

SOCIÉTE INDUSTRIELLE POUR L' AÉRONAUTIQUE.

Head Office and Works: 27, Rue du Pont, Neuilly-sur-Seine.

This Company was formed in 1938 and from then until 1940 was engaged in the manufacture of components for Mureaux and Loire military aircraft.

During the Occupation the factory at Neuilly produced the prototype of the Arado Ar 396 two-seat advanced training monoplane for the German authorities. This design was re-designated the S.10 after the liberation, and a number has been ordered by the Ministry of Armament. For civilian use the Société has produced the S.20 four-seat cabin monoplane, the S.50 single-seater and the S.70 twin-engined light transport, all of which are described herewith.

S.I.P.A. S.10.

S.10 is the designation given to the German Arado Ar 396 low-wing monoplane, three prototypes of which were projected by S.I.P.A. during the Occupation. This aircraft, a two-seat advanced trainer, has since been ordered by the French Government and is in production in a slightly modified form. The 600 h.p. Argus As 411 power plant of the original aircraft has been replaced by a Renault 12 S.00 (the French-built Argus) of similar output, and the wings and tailplane have been modified. The following specification applies to the production aircraft.

Type.—Two-seat Advanced Trainer.

Wings.—Cantilever low-wing monoplane. Composite strueture with constant-chord centre-section of steel construction, and wooden tapered outer sections. Wooden slotted ailerons on outer wings ; aileron area (each) 0.842 sq. m. (9.25 sq. ft.). Wooden slotted trailing-edge flaps extend between ailerons and under fuselage ; outer flap area (each) 0.71 sq. m. (7.6 sq. ft.) ; centre flap area 0.614 sq. m. (6.6 sq. ft.). Gross wing area 18.30 sq. m. (196.9 sq. ft.).

Fuselage.—Composite structure with steel-framed forward section and wooden rear section.

Tail Unit.—Cantilever monoplane type with forwardly-set fin. Composite structure ; fin and tailplano of metal construction and movable surfaces of wood. Trim-tabs in rudder and elevators. Tailplane span 3.90 m. (12 ft. 9½ in.), Rudder height 1.65 m. (5 ft. 5 in.) ; total horizontal area 3.472 sq. m. (37.34 sq. ft.) ; total vertical area 1.51 sq. m. (16.24 sq. ft.).

Landing Gear.—Retractable two-wheel type. Main wheels 660 × 160 carried on shock-absorber legs which retract rearwards into wing centre-section and turn through 90 degrees so that wheels lie flat within wings. Non-retractable tail-wheel 290 × 140 or 260 × 80 carried on shock-absorber leg.

Power Plant.—One Renault 12 S 00 twelve-cylinder vee air-cooled engine developing a normal output of 390 h.p. at 3,100 r.p.m. at 2,600 m. (8,530 ft.) and a maximum output of 600 h.p. at 3,300 r.p.m. at 600 m. (1 970 ft.) and driving Ratier three-blade variable-pitch airscrew, 2.65 m. (8 ft. 8½ in.) diameter. Two fuel tanks of 105 litres (23 Imp. gallons) and 135 litres (30 Imp. gallons) capacity. Oil capacity 30 litres (6.6 Imp. gallons).

Accommodation.—Crew of two in tandem cockpits enclosed by continuous transparent canopy.

Dimensions.—Span 11.0 m. (36 ft. 1 in.), Length 9.328 m. (30 ft. 7¼ in.), Height (tail down) 2.45 m. (8 ft.), Height (tail up) 3.615 m. (11 ft. 10 in.).

Weights and Loadings.—Weight empty 1,678 kg. (3,699 lbs.), Equipment 25 kg. (55 lbs.), Fuel and oil 190 kg. (419 lbs.), Crew 177 kg. (390 lbs.), weight loaded 2,070 kg. (4,563 lbs.) Wing loading 113 kg./sq. m. (23.13 lbs./sq. ft.), Power loading 3.45 kg./h.p. (7.6 lbs./h.p.).

Performance (At maximum power).—Maximum speed 370 km.h. (230 m.p.h.) at 2,400 m. (7,875 ft.), Speed at sea level 330 km.h. (205 m.p.h.), Initial rate of climb 540 m./min. (1,772 ft./min.), Climb to 6,000 m. (19,685 ft.) 14 minutes, Service ceiling 8,300 m. (27,230 ft.).

THE S.I P.A. S.20.

Type.—Four-seat Cabin Monoplane.

Wings.—Cantilever low-mid-wing monoplane. All-wood structure with constant taper in chord and thickness from root to tip. Single-spar construction with chordwise ribs and spanwise stringers and plywood covering. Fabric-covered wooden ailerons, with two sets of slotted flaps in tandem between ailerons and fuselage. Wing area 14 sq. m. (150.63 sq. ft.).

Fuselage.—Wooden structure in three main sections comprising nose section, cabin section and rear monocoque section.

Tail Unit.—Wooden cantilever structure with twin fins and rudders mounted as endplates to tailplane. Dihedral tailplane of single-spar construction. Control surfaces dynamically-balanced and covered with fabric.

Landing Gear.—Retractable two-wheel type. Main wheels 475 × 170 each carried on cantilever Messier shock-absorber leg which retracts inwards into wing. Hydraulic operation, and hydraulically-operated brakes. Track 3 m. (9 ft. 10 in.). Tail-wheel 260 × 80 retracts into fuselage.

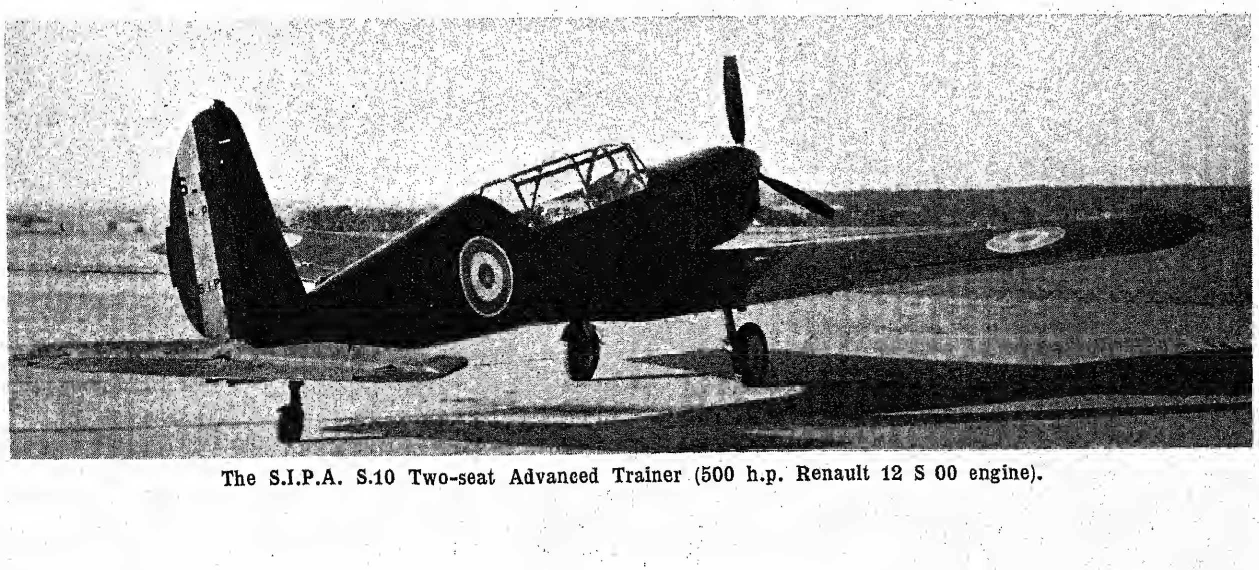
Power Plant.—One D.H. Gipsy Major 10 four-cylinder in-line inverted air-cooled engine developing 145 h.p. at 2,400 r.p.m. and driving D.H. two-blade variable-pitch airscrew, or one Mathis G8R eight-cylinder inverted vee air-cooled engine developing 185 h.p. at 3,450 r.p.m. Fuel capacity 180 litres (39.6 Imp. gallons) ; oil capacity 18 litres (4 Imp. gallons).

Accommodation.—Enclosed cabin seating pilot (on port) and one passenger side-by-side in front with dual controls, and two passengers aft on full-width seat. Access door on each side, hinged at top. Baggage compartment aft of rear seats.

Dimensions.—Span 10.34 m. (33 ft. 11 in.), Length 8.145 m. (26 ft. 8½ in.), Height 2.203 m. (7 ft. 3 in.).

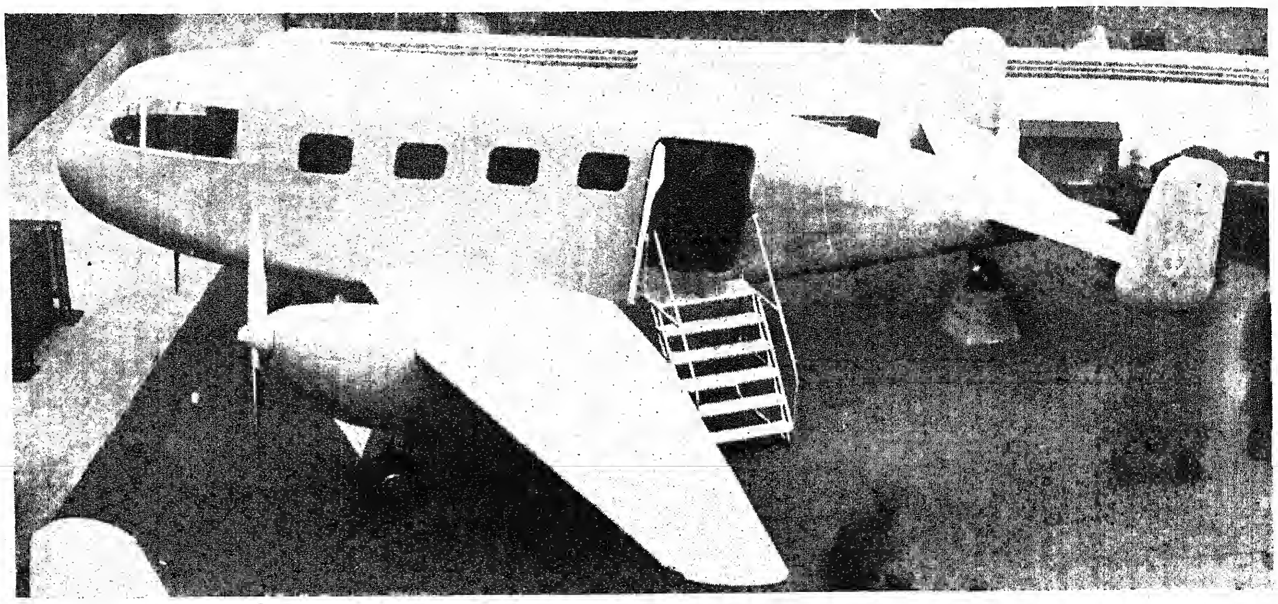
Weights and Loadings (Gipsy Major engine).—Weight empty 550 kg. (1,212.5 lbs.), Fuel and oil 150 kg. (331 lbs.), Weight loaded 1,000 kg. (2,205 lbs.), Wing loading 71 kg./sq. m. (14.54 lbs./sq. ft.), Power loading 7 kg./CV (15.65 lbs./h.p.).

Performance (Gipsy Major engine).—Maximum speed 270 km.h. (168 m.p.h.), Cruising speed (70% power) 240 km.h. (149 m.p.h.), still-air range 1,000 km. (621 miles), Tako-off distance at 20 m. (66 ft.) 170 m. (186 yds.), Fuel consumption 14 litres/100 km. (5.96 Imp. gallons/100 miles).



The S.I.P.A. S.10 Two-seat Advanced Trainer (500 h.p. Renault 12 S 00 engine).

S.I.P.A.—*continued.*



The S.I.P.A. S.70 Light Transport (two 210 h.p. Mathis G8R engines).—(*The Aeroplane*).

THE S.I.P.A. S.50.

Type.—Single-seat Open or Enclosed Monoplane.

Wings.—Cantilever mid-wing monoplane built in two main sections attached to sides of fuselage. Composite structure with metal framework and plywood covering, over which is a covering of fabric. Wooden slotted ailerons with fabric covering, and manually-operated slotted trailing-edge flaps similarly constructed. Wing area 7.80 sq. m. (83.93 sq. ft.).

Fuselage.—Metal structure of triangular cross-section with plywood covering, over which is a covering of fabric.

Tail Unit.—Cantilever monoplane type. Fin and tailplane have metal frames and plywood covering. Rudder and elevators of wooden framework and fabric covering. Adjustable tailplane incidence.

Landing Gear.—Fixed two-wheel type. Main wheels each carried on cantilever oleo-pneumatic shock-absorber leg and enclosed in spat. Low pressure 350 × 150 tyres. Hydraulically-operated brakes. Track 1.50 m. (4 ft. 11 in.). Fixed tail-skid or wheel.

Power Plant.—One 40 h.p. Mathis G2F two-cylinder horizontally-opposed air-cooled engine driving two-blade fixed-pitch wooden airscrew. Other engines of similar weight and output may be fitted. Fuel capacity 45 litres (9.9 Imp. gallons) in fuselage tank. Oil capacity 7 litres (1.54 Imp. gallons).

Accommodation.—Pilot's cockpit in centre-section of fuselage may be fitted with large windscreen, or fully enclosed by transparent canopy.

Dimensions.—Span 7.53 m. (24 ft. 8½ in.), Length 4.90 m. (16 ft. 1 in.), Height 1.52 m. (5 ft.).

Weights and Loadings.—Weight empty 185 kg. (408 lbs.), Fuel and oil 38 kg. (84 lbs.), Weight loaded 330 kg. (728 lbs.), Wing loading 42 kg./sq. m. (8.6 lbs./sq. ft.), Power loading 8.2 kg./CV (18.3 lbs./h.p.).

Performance.—Maximum speed 200 km.h. (124 m.p.h.), Cruising speed (70% power) 180 km.h. (112 m.p.h.), Landing speed 60 km.h. (37 m.p.h.), Rate of climb 234 m./min. (768 ft./min.), Ceiling 5,000 m. (16.405 ft.), Still-air range 800 km. (497 miles), Cruising fuel consumption 10 litres/hr. (2.2 Imp. gallons/hr.).

S.I.P.A. S.70.

Type.—Twin-engined Light Transport.

Wings.—Cantilever low-wing monoplane. Composite structure in three main sections comprising constant-chord centre-section bolted to fuselage and carrying engine nacelles, and two tapered outer sections. Each section consists of a wooden torsion box formed by spars to which are fixed detachable metal leading and trailing-edges. Plywood covering. Fabric-covered slotted ailerons, and hydraulically-operated slotted trailing edge flaps in two sections each side between ailerons and fuselage. Wing area 24.59 sq. m. (264.6 sq. ft.).

Fuselage.—Composite structure with metal forward section accommodating cabin and monocoque rear section of wooden vertical frames, longitudinal stringers and stressed plywood covering.

Tail Unit.—Composite structure consisting of cantilever dihedral tailplane, two-piece elevator and twin fins and rudders mounted as endplates. Wooden tailplane and fin, with plywood covering. Elevators and rudders have metal frames and are fabric-covered. Control surfaces dynamically-balanced and fitted with automatic trim-tabs.

Landing Gear.—Retractable two-wheel type. Main wheels carried on shock-absorber legs retract rearwards into engine nacelles and are fully enclosed. Dunlop 560 × 20 tyres. Hydraulically-operated brakes. Track 3.86 m. (12 ft. 8 in.). Fixed tail-wheel with Dunlop 355 × 150 tyre.

Power Plant.—Two 180-210 h.p. Mathis G8R eight-cylinder inverted vee air-cooled geared engines driving Legère two-blade airscrews. Three fuel tanks with total capacity of 350 litres (77 Imp. gallons). Oil tank of 18 litres (4 Imp. gallons) capacity in each engine nacelle.

Accommodation.—Enclosed cabin accommodates pilot on centrally-placed seat forward, with eight passenger seats aft arranged four on each side with central aisle. Luggage racks above seats. Toilet compartment at rear on starboard side. Main access door on port side at rear of cabin. Baggage compartment aft measures 1.0 m. × 1.2 m. × 1.15 m. (3 ft. 3⅜ in. × 3 ft. 11 in. × 3 ft. 9 in.) and has volume of 1.5 cub. m. (53 cub. ft.). For freight carrying passenger seats may be removed to provide volume of 7.5 cub. m. (265 cub. ft.).

Dimensions.—Span 13.80 m. (45 ft. 3¼ in.), Length 10.20 m. (33 ft. 5⅝ in.), Height 3.60 m. (11 ft. 9¼ in.).

Weights and Loadings.—Weight empty (with oil) 1,294 kg. (2,934 lbs.), Fuel 252 kg. (556 lbs.), Weight loaded (with six passengers and 200 kg. = 441 lbs. freight) 2,322 kg. (5,119 lbs.), Weight loaded (with eight passengers and luggage) 2,428 kg. (5,353 lbs.), Wing loading (with six passengers) 95 kg./sq. m. (19.45 lbs./sq. ft.), Wing loading (with eight passengers) 99 kg./sq. m. (20.3 lbs./sq. ft.), Power loading (with six passengers 6.45 kg./CV (14.4 lbs./h.p., Wing loading (with eight passengers) 6.75 kg./CV (15.1 lbs./h.p.).

Performance.—Maximum speed 270 km.h. (168 m.p.h.), Cruising speed (70% power) 240 km.h. (149 m.p.h.), Still-air range 1,000 km. (621 miles), Fuel consumption 34 litres/100 km. (12 Imp. gallons) 100 miles).

STARCK.

AVIONS STARCK.

Head Office: 7, Boulevard de Dixmude, Paris (17e).
Works: Boulogne-Billancourt (Seine).

Avions Starck has produced the Type A.S.70 single-seat monoplane and the Type A.S.57 two-seater, descriptions of which follow.

THE STARCK A.S.70 JAC.

The A.S.70 is a single-seat cantilever low-wing monoplane intended for sporting flying or aerobatic purposes. It is of welded steel-tube and wooden construction with fabric covering, and has a cantilever monoplane tail-unit. The landing gear is of the fixed two-wheel type.

The power plant is a 45 h.p. Salmson 9 ADL nine-cylinder radial air-cooled engine or a 65 h.p. Walter Mikron III four-cylinder in-line inverted engine driving a two-blade fixed-pitch wooden airscrew. Other engines of similar power and weight may be installed.

Dimensions.—Span 7.40 m. (24 ft. 3 in.), Length 5.36 m. (17 ft. 7 in.), Wing area 8 sq. m. (86 sq. ft.).

Weights and Loadings (Salmson 9 ADL engine).—Weight empty 212 kg. (467 lbs.), Weight loaded 320 kg. (705 lbs.), Wing loading 40 kg./sq. m. (8.2 lbs./sq. ft.), Power loading 7.1 kg./h.p. (15.65 lbs./h.p.).

Performance (Salmson 9 ADL engine).—Maximum speed 185 km.h. (115 m.p.h.), Cruising speed 167 km.h. (104 m.p.h.), Range 418 km. (260 miles).

THE STARCK A.S.57.

Type.—Two-seat Cabin Monoplane.

Wings.—Cantilever low-wing monoplane. Wooden structure in three sections consisting of constant-chord centre-section integral with fuselage and two tapered outer wings. Built-up box-spar, and stressed plywood skin. Full-span slotted ailerons which act also as flaps. Fixed leading-edge slots in outer wings. Wing area 11 sq. m. (118 sq. ft.).

Fuselage.—Wooden monocoque structure with plywood skin.

Tail Unit.—Cantilever monoplane type of wooden construction, with stressed plywood skin over fixed surfaces and fabric-covered rudder and elevators.

Landing Gear.—Fixed two-wheel type. Main wheels carried on Messier cantilever oleo-pneumatic shock-absorber legs.

Power Plant.—One 75 h.p. Régnier four-cylinder in-line inverted air-cooled engine driving two-blade fixed-pitch airscrew. Other engines of similar weight and of 60, 75 or 95 h.p. may be fitted.

STARCK—*continued.*

Fuel capacity 80 litres (17.6 Imp. gallons), Oil capacity 10 litres (2.2 Imp. gallons).
ACCOMMODATION.—Enclosed cabin seating two side-by-side.
DIMENSIONS.—Span 8.80 m. (28 ft. 10 in.), Length 6.45 m. (21 ft. 2 in.).
WEIGHTS AND LOADINGS.—Weight empty 310 kg. (683 lbs.), Disposable load 290 kg. (639 lbs.), Weight loaded 600 kg. (1,322 lbs.), Wing loading 54.5 kg./sq. m. (11.1 lbs./sq. ft.), Power loading 8 kg./CV (17.6 lbs./h.p.).
PERFORMANCE.—Maximum speed 200 km.h. (124 m.p.h.), Cruising speed 185 km.h. (115 m.p.h.), Landing speed 65 km.h. (40 m.p.h.), Ceiling 5,800 m. (19,000 ft.), Range 800 km. (497 miles), Take-off run 90 m. (98 yds.), Landing run 60 m. (66 yds.).

SUD-EST.

SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DE SUD-EST (S.N.C.A.S.E.).

HEAD OFFICE: 6, AVENUE MARÇEAU, PARIS (8E).

WORKS: LA COURNEUVE, CLICHY, ARGENTEUIL (all in the Paris region), TOULOUSE, MARIGNANE (MARSEILLES), CANNES AND BOUFARIK (ALGIERS).

President-Director General: André Deprez.

Commercial Director: Louis Maurice Sauvageot.

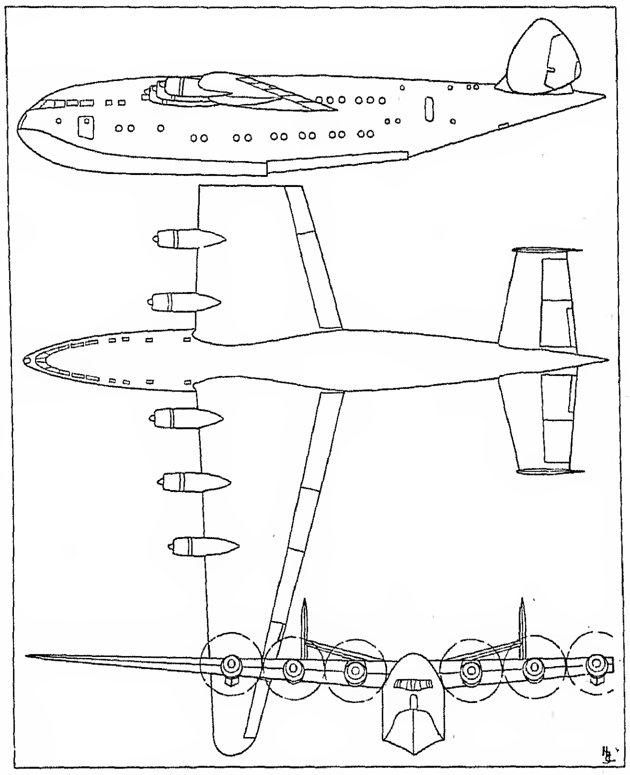
Technical Director: André Vautier.

Chief of the Technical Service and Test-flying (Marseilles): Jean Lecarme.

The Société Nationale de Constructions Aéronautiques de Sud-Est was formed on December 21, 1936, in accordance with the Law of Nationalisation of Military Industries. It included factories formerly owned by the Lioré-et-Olivier, Potez-C.A.M.S., Romano and S.P.C.A. Companies. In 1941 it absorbed the factories of the former Société Nationale de Constructions Aéronautiques du Midi.

All military construction having to be abandoned in July, 1940, S.N.C.A.S.E. turned to the design and development of civil aircraft. The first fruits of this programme fell into the hands of the enemy after the complete occupation of France, or were destroyed by air bombardment. In spite of this misfortune and thanks to the clandestine work of the technical bureaux, Aerosudest was able soon after the liberation of France to embark on the construction of a wide range of civil aircraft, details of which follow. Projected designs include the S.E.580 single-seat fighter to be powered by a 2,500 h.p. Hispano-Suiza twenty-four cylinder engine; the S.E.1200 140-ton flying-boat, the S.E.2000 four-engined 50-passenger transport monoplane and the S.E.2400 14-ton jet-propelled fighter.

The Etablissements Aéronautique Nord-Africains with works at Baufarik (Algiers) forms part of the S.N.C.A.S.E.



The S.E.200 Commercial Flying-boat.

THE S.E.200.

The S.E. 200 was originally designed to a French Air Ministry specification issued in 1936 for a trans-Atlantic flying-boat and the design was initiated by the Lioré-et-Olivier concern before the nationalisation of the major portion of the French aircraft industry and the incorporation of the LeO Company in the S.N.C.A.S.E.

Four prototypes of the S.E.200 were under construction in the Marignane factory at Marseilles at the outbreak of war. The first two were seized by the Germans in November, 1942, but the first was completed and flew in August, 1943. It was taken by the German authorities to Friedrichshafen on Lake Constance, where in 1944 it was destroyed during an R.A.F. raid. The first prototype was fitted with 1,500 h.p. Wright Cyclone engines. The second aircraft was also destroyed (at Marignane) and the third was badly damaged while still under construction.

The remains of No. 3, however, were salvaged and completed, and it made its first flight at Marignane on April 2, 1946. It is this version which is described hereunder. No. 4 was scheduled to be completed at the end of 1946. It was originally to be fitted with semi-retractable and inflatable wing-tip floats as shewn in the accompanying general arrangement drawing, but these have been abandoned in favour of an orthodox type as on the earlier versions.

TYPE.—Six-engined long-range Commercial flying-boat.

WINGS.—Cantilever monoplane structure. Aerofoil section NACA 2418 at root, NACA 2409 at tips. All-metal structure with a stressed metal skin, the upper surface consisting of an inner skin with span-wise corrugations to which the outer smooth skin is riveted. The under surface consists of a smooth skin reinforced internally with stiffeners. Gross wing area 340 sq. m. (3,658.4 sq. ft.). Metal ailerons in two sections each side, with trim-tabs in inner portions. Trailing-edge flaps in three sections each side.

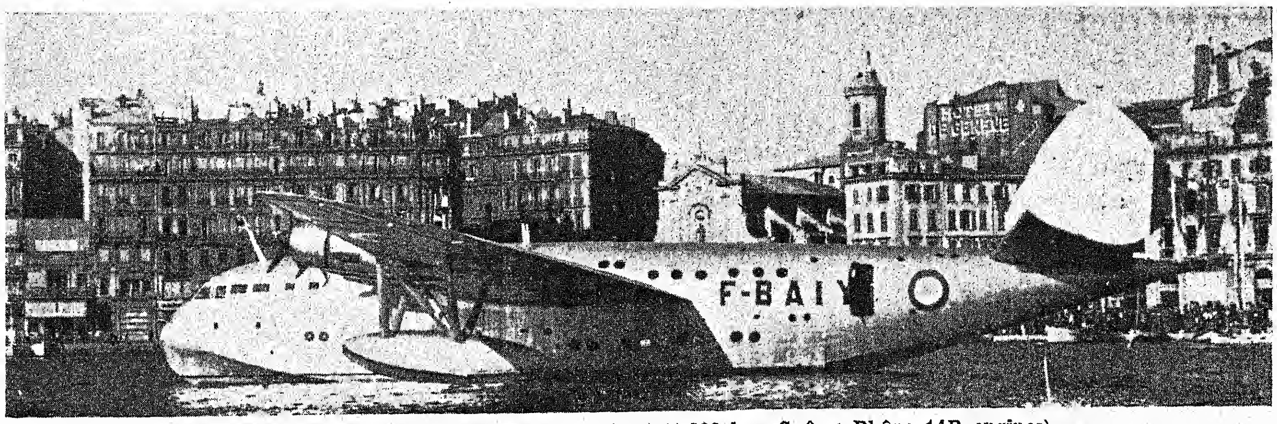
HULL.—All-metal two-step structure divided into two decks.

FLOATS.—Fixed single-step stabilising floats attached to outer wings by steel-tube struts.

TAIL UNIT.—Cantilever structure consisting of dihedral tailplane with twin fins and rudders mounted as endplates and slightly toed-in. Balanced rudders and elevators, with trim-tabs in each.

POWER PLANT.—Six Gnôme-Rhône 14R 26/27 fourteen-cylinder two-row radial air-cooled engines, each developing a normal output of 1,320 h.p. at 7,720 ft. (2,500 m.), and with a maximum of 1,600 h.p. available for take-off. Three-blade reversible-pitch airscrews. Fuel capacity (normal) 36,000 litres (7,920 Imp. gallons) in inter-spar wing-tanks, plus 4,800 litres (1,056 Imp. gallons) reserve.

ACCOMMODATION.—Hull divided into two decks, with stairway at each end. Crew of eight to ten in forward portion of upper deck. Normal accommodation for 80 passengers by day, and 40 by night. Upper deck also provides main freight compartment (between wing spars), de luxe cabin, upper passenger cabin, and toilet compartments. Lower deck contains forward freight compartment, galley, dining saloon, with bar, lower passenger cabin, and rear freight compartment.



The S.E.200 No. 3 Long-range Flying-boat (1,600 h.p. Gnôme-Rhône 14R engines).

SUD-EST—*continued.*

DIMENSIONS.—Span 52.20 m. (171 ft. 3in.), Length 40.15 m. (131 ft. 8½ in.).

WEIGHTS AND LOADINGS (Designed).—Weight empty 32,746 kg. (72.192 lbs.), Disposable load 27,000 kg. (59,524 lbs.), Weight loaded 72,000 kg. (158,731 lbs.). Wing loading 212 kg./sq. m. (43.4 lbs./sq. ft.), Power loading (at 1,320 h.p. per engine) 9.1 kg./h.p. (20 lbs./h.p.).

PERFORMANCE (Estimated).—Maximum speed 378 km.h. (235 m.p.h.) at 2,500 m. (7,720 ft.), Maximum speed at sea level 354 km.h. (220 m.p.h.), Cruising speed 305 km.h. (190 m.p.h.), Maximum range in 60 km.h. (37 m.p.h.) wind 6,060 km. (3,766 miles).

THE S.E.161 LANGUEDOC.

The S.E. 161 was originally designed as the S.O. (Bloch) 161. The prototype flew at Bordeaux in 1939 but did not complete its tests until January, 1942. Although ordered in series by the Vichy Government from the S.N.C.A.S.E. in December, 1941, no aircraft other than the prototype, which was confiscated by the Germans, was delivered during the war. Put into production after the liberation of France to the order of the Provisional Government, the first post-war production S.E. 161 flew in September, 1945. Thirteen have been delivered to Air-France.

TYPE.—Four-engined airliner.

WINGS.—Cantilever low-wing monoplane. Two-spar light-alloy structure in four main sections consisting of two half centre-sections and two outer wings with detachable tips. Main structural member is torsion box formed by the two spars, ribs and stressed metal skin. Spars have angle-section booms with sheet web stiffeners, and continue through fuselage. Sheet metal ribs placed obliquely in centre-section to form Warren-girder structure, and at right-angles to spars in outer wings. Centre-sections bolted to fuselage. Portions of leading-edge detachable for inspection. 28.77% taper on leading-edge. Dihedral (centre-section) 4 degrees (outer wings) 9 degrees. Incidence 2.5 degrees. Root chord 5.6 m. (18 ft. 4½ in.), Tip chord 1,90 m. (6 ft. 3 in.), Chord at joint of centre-section and outer wings 3.97 m. (13 ft. 0 in.). Gross wing area 111.32 sq. m. (1,197.80 sq. ft.). All-metal ailerons in three sections each side, with metal covering. Aileron span 5.63 m. (19 ft. 4 in.), Maximum chord 0.805 m. (2 ft. 7 in.), Total area 7.40 sq. m. (79.62 sq. ft.). Aileron movement 22 degrees up, 19 degrees down. Electrically-operated trim and balance-tabs in inner and outer sections. Tab span (inner) 0.81 m. (2 ft. 11¼ in.), Tab span (outer) 0.80 m. (2 ft. 7½ in.). Slotted trailing-edge flaps in four sections each side, with small auxiliary flap under fuselage. Pneumatic operation. Depression (take-off) 12 degrees, (landing) 38 degrees. Flap span 6.76 m. (22 ft. 2 in.), Maximum chord 1.0 m. (3 ft. 3 in.), Total main flap area 11.83 sq. m. (127.28 sq. ft.), Auxiliary flap span 2.18 m. (7 ft. 2in.), Chord .61 m. (2 ft.), Area 1.81 sq. m. (19.47 sq. ft.).

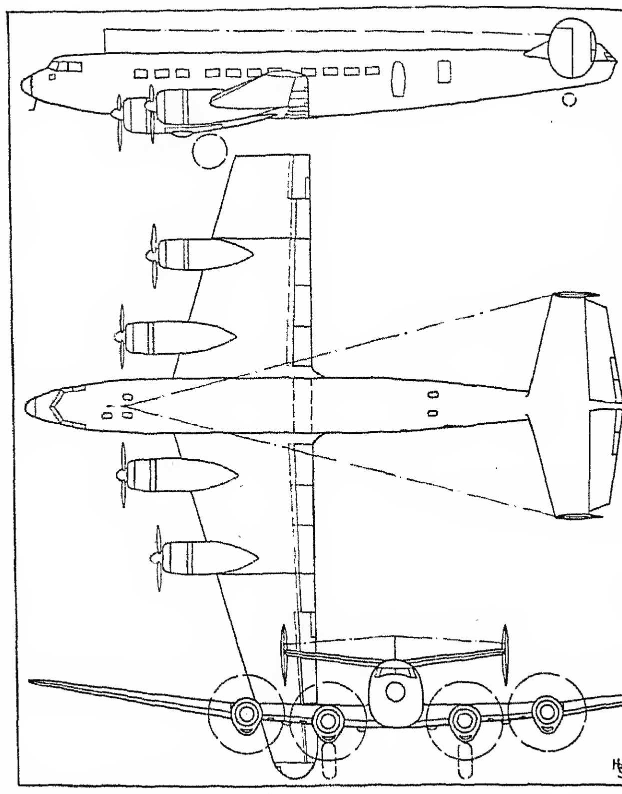
FUSELAGE.—All-metal monocoque structure in four main sections: nose section, cabin section, rear fuselage and tail section. Transversal frames, longitudinal stringers and stressed metal skin. Maximum depth 2.66 m. (8 ft. 8¾ in.), Maximum width 2.28 m. (7 ft. 5 in.), Frontal area 5.2 sq. m. (55.9 sq. ft.).

TAIL UNIT.—All-metal cantilever structure consisting of two-spar dihedral tailplane with twin fins and rudders mounted as endplates. Metal covering to tailplane and fins, and fabric covering to movable surfaces. Horn-balanced rudders. Tailplane span 8.8 m. (28 ft. 10½ in.), Tailplane and elevator area 24.68 sq. m. (265.56 sq. ft.) Elevator area (total) 8.42 sq. m. (90.59 sq. ft.), Total vertical area 7.70 sq. m. (82.85 sq. ft.), Rudder area 3.78 sq. m. (40.67 sq. ft.). Trim and balance-tabs in rudders and elevators. Rudder tab height (upper) 0.88 m. (2 ft. 10½ in.), (lower) 0.52 m. (1 ft. 8½ in.), Elevator tab span (inner) 1.03 m. (3 ft. 4 in.), (outer) 0.9 m. (2 ft. 11½ in.).

LANDING GEAR.—Retractable two-wheel type. Main wheels 1,500 × 530 m/m. carried between twin shock-absorber legs which retract forward into inner engine nacelles, and are partly enclosed by twin doors. Wheel travel 36.5 c/m. (14.36 in.), Track 5.69 m. (18 ft. 8 in.). Tail-wheel 560 × 236 m/m. retracts forward into fuselage and is enclosed by twin doors. Mechanical operation.

POWER PLANT.—Four Gnôme-Rhône 14 N 44/45 or 54/55 fourteen-cylinder two-row radial air-cooled engines developing a normal output of 1,020 h.p. at 2,400 r.p.m. and with 1,260 h.p. available for take-off and driving Ratier three-blade electrically-operated variable-pitch airscrews 3.30 m. (10 ft. 10 in.) diameter. Port airscrews rotate right-hand; starboard rotate left-hand. Inner and outer engine centres 3.25 m. (10 ft. 3 in.). Four pairs of fuel tanks in wings with total capacity of 7,220 litres (1,588 Imp. gallons), reserve tank of 1,200 litres (264 Imp. gallons) capacity in fuselage. Four oil-tanks with total capacity of 604 litres (133 Imp. gallons).

ACCOMMODATION.—Crew of five, pilot (on port) and co-pilot/navigator side-by-side with dual controls, and radio-operator (on port) and flight engineer behind; steward immediately behind in galley. Main cabin has standard accommodation for 33 passengers in eleven rows of three, two on starboard and one on port. Alternative arrangements allow for 12 or 24 passenger seats. Entry doors at rear on both sides. Four emergency exits. Two toilet compartments at rear. Four freight compartments: three under cabin floor with respective capacities of 2.5 cub. m. (88 cub. ft.), 2.8 cub. m. (99 cub. ft.) and 2.2 cub. m. (78 cub. ft.), and one of 2.7 cub. m. (95 cub. ft.) capacity on port side aft of toilet compartments. Total capacity 10.2 cub. m. (360 cub. ft.).



The S.E.161 Languedoc Airliner.

EQUIPMENT.—Alkan Type 11 automatic pilot. Goodrich de-icing equipment on wings and tail-unit.

DIMENSIONS.—Span 29.39 m. (96 ft. 5 in.), Length 24.26 m. (79 ft. 7 in.), Height (tail down) 5.14 m. (16 ft. 10 in.).

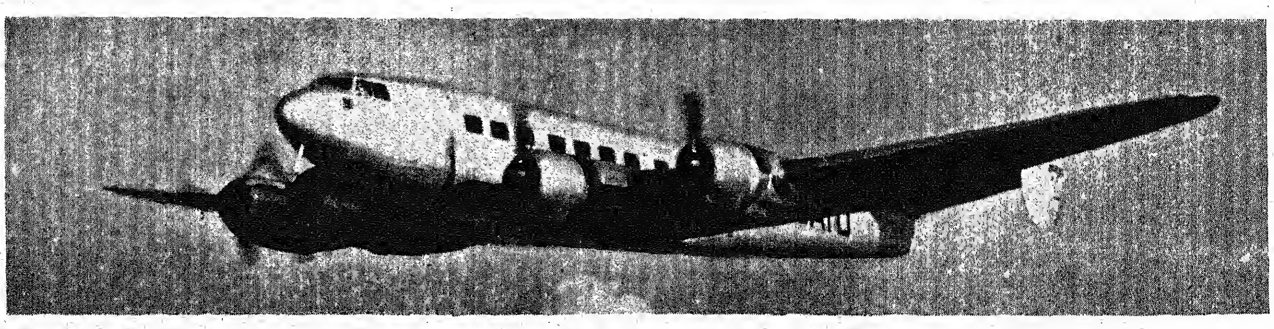
WEIGHTS AND LOADINGS (33-passenger version, with 1,000 kg.=2,205 lbs. freight).—Weight empty 12.651 kg. (27.890 lbs.), Equipment 1,636 kg. (3.607 lbs.), Fuel 1,920 kg. (4,233 lbs.), Crew 400 kg. (882 lbs.), Useful load 3,970 kg. (8,752 lbs.), Weight loaded 20,577 kg. (45,364 lbs.), Wing loading 184.88 kg./sq. m. (37.86 lbs./sq. ft.), Power loading 20.16 kg./h.p. (44.47 lbs./h.p.).

WEIGHTS AND LOADINGS (24-passenger version, with 1,000 kg.=2,205 lbs. freight).—Weight empty 12,651 kg. (27,890 lbs.), Equipment 1,600 kg. (3,527 lbs.), Fuel 3,190 kg. (7,033 lbs.), Crew 400 kg. (882 lbs.), Useful load 3,160 kg. (6,967 lbs.), Weight loaded 21,001 kg. (46,299 lbs.), Wing loading 183.80 kg./sq. m. (37.64 lbs./sq. ft.), Power loading 20.58 kg./h.p. (45.39 lbs./h.p.).

WEIGHTS AND LOADINGS ("South Atlantic" 12-passenger version, with 1,000 kg.=2,205 lbs. freight).—Weight empty 12,701 kg. (28,000 lbs.), Equipment 1,440 kg. (3,175 lbs.), Fuel 6,500 kg. (14,330 lbs.), Crew 400 kg. (882 lbs.), Useful load 1,900 kg. (4,189 lbs.), Weight loaded 22,941 kg. (50,576 lbs.), Wing loading 206.08 kg./sq. m. (42.21 lbs./sq. ft.), Power loading 22.48 kg./h.p. (49.58 lbs./h.p.).

WEIGHTS AND LOADINGS (Freighter version).—Weight empty 12,678 kg. (27,949 lbs.), Equipment 1,451 kg. (3,199 lbs.), Fuel 1,920 kg. (4,233 lbs.), Crew 320 kg. (706 lbs.), Useful load 6,500 kg. (14,330 lbs.), Weight loaded 22,869 kg. (50,417 lbs.), Wing loading 205.45 kg./sq. m. (42.08 lbs./sq. ft.), Power loading 22.41 kg./h.p. (49.42 lbs./h.p.).

PERFORMANCE (at 22,941 kg.=50,576 lbs.).—Maximum speed 440 km.h. (273 m.p.h.) at sea level, Maximum speed at 2,300 m. (7,548 ft.), 430 km.h. (267 m.p.h.), Cruising speed (65% power) 375 km.h. (233 m.p.h.) at 2,300 m. (7,548 ft.), Landing speed 110 km.h. (68 m.p.h.), Rate of climb 180 m./min. (591 ft./min.), Ceiling 7,500 m. (24,606 ft.), Range (normal) 2,700 km. (1,678 miles), Maximum range 3,200 km. (1,988 miles).



The S.E.161 Languedoc Airliner (four 1,260 h.p. Gnôme-Rhône 14 N engines).

SUD-EST—*continued.*

The S.E. 700 Three-seat Cabin Helicopter (220 h.p. Renault 6 Q-01 engine).

THE S.E. 700.

TYPE.—Three-seat cabin Helicopter.

ROTORS.—Three blade rotor with controllable pitch change for jump take-off. Auxiliary drive from engine through a transmission box on the airscrew drive shaft, which includes an elastic coupling clutch and rotor brake, and a vertical shaft to a reduction gear (15 : 64) in the rotor head. Constant-chord rotor blades with duralumin sheet spar and ribs. Leading-edge of bakelite, remainder fabric-covered.

FUSELAGE.—Wooden structure comprising a main structural member which forms the floor of the cabin forward and the baggage compartment aft and a light superstructure in two parts, the forward part of wood forming the cabin and the after part, fabric-covered, continuing the lines of the cabin aft. These two sections join at the bulkhead which serves as a support for the rotor pylon.

TAIL UNIT.—Braced monoplane type with terminal fins, the lower portions of which enclose the main landing wheels. Tailplane fitted with tabs adjustable on the ground only. Fin and rudder mounted under the rear fuselage in the airscrew slipstream to ensure control at low speed. Wooden-framed surfaces with fabric covering.

LANDING GEAR.—Tricycle type. Steerable and retractable nose wheel in a Messier sprung fork. Fixed main wheels in the fins. Brakes on main wheels.

POWER PLANT.—One 220 h.p. Renault 6 Q-01 (S.E.700) or 330 h.p. Béarn 6-D (S.E.700A) six-cylinder inverted air-cooled engine mounted within the fuselage beneath the baggage compartment and cooled by engine-driven suction fan. Cooling-air enters beneath cabin and deflectors within the engine cowling direct the air between the cylinders and through oil cooler, the suction fan being situated aft of the engine. Extension shaft drives a Ratier electrically-operated constant-speed tractor airscrew through gear box mounted in the nose.

ACCOMMODATION.—Enclosed cabin seating pilot and two passengers, the latter on a cross bench aft. Cabin may be furnished to suit various purposes, *i.e.* carrying light freight, ambulance, photographic survey, etc.

DIMENSIONS.—Diameter of rotor 13.3 m. (43 ft. 7 in.), Length of fuselage 6.55 m. (21 ft. 6 in.), Width over tail-unit 4.6 m. (15 ft. 1 in.), Height overall 3.8 m. (12 ft. 5¾ in.).

WEIGHTS (S.E. 700A).—Weight empty 1,400 kg. (3,080 lbs.), Pilot 80 kg. (176 lbs.), Fuel and oil 200 kg. (440 lbs.), Pay load 320 kg. (704 lbs.), Weight loaded 2,000 kg. (4,400 lbs.).

PERFORMANCE (S.E. 700A—330 h.p. Béarn 6-D engine).—Maximum speed 265 km.h. (164.5 m.p.h.), Cruising speed 220 km.h. (137 m.p.h.), Minimum forward speed at sea level 45 km.h. (28 m.p.h.) Range 660 km. (410 miles), Duration 3 hours.

THE S.E. 1010.

TYPE.—Long-range monoplane for photographic or general transport duties.

WINGS.—Cantilever mid-wing monoplane. All-metal structure with sharply-tapered trailing edge. Dihedral 6 degrees, incidence nil, root chord 5.62 m. (19 ft. 0 in.), Tip chord 1.6 m. (5 ft. 3 in.), Gross wing area 116.3 sq. m. (1,251 sq. ft.). Statically-balanced wing-tip ailerons with hinge-line at approximately 45 degrees to fuselage centre-line. Long-span trailing-edge flaps between detachable wing-tips and fuselage.

FUSELAGE.—Circular-section all-metal monocoque structure. Maximum diameter 2.40 m. (7 ft. 10½ in.).

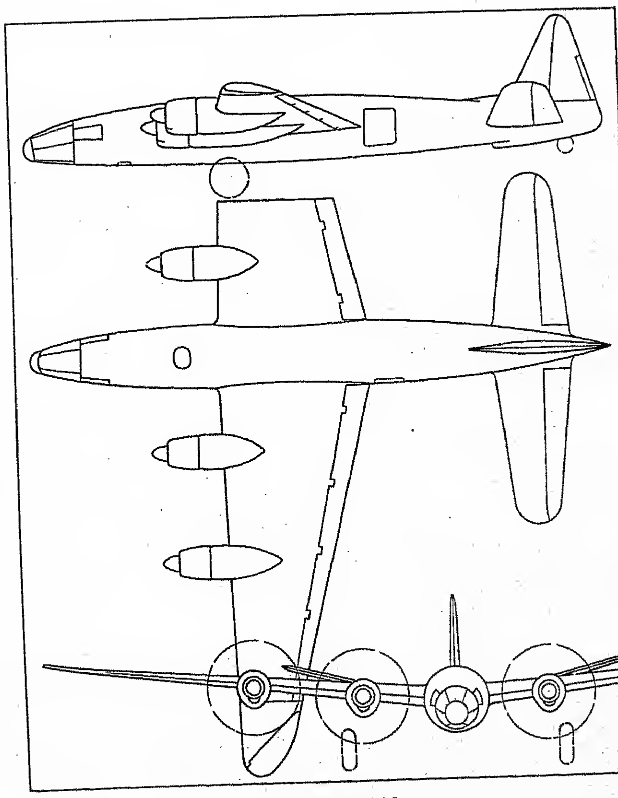
TAIL UNIT.—Cantilever monoplane type, with dihedral tailplane and statically-balanced rudder and elevators. Trim-tab in rudder. Tailplane dihedral 14 degrees, Incidence minus 20 minutes, Span 13.2 m. (43 ft. 3½ in.), Area 19.55 sq. m. (210.35 sq. ft.), Elevator area (total) 9,78 sq. m. (105.23 sq. ft.), Fin area 3 sq. m. (32.28 sq. ft.) Rudder area 3,42 sq. m. (36.6 sq. ft.).

LANDING GEAR.—Retractable two-wheel type. Each main wheel is carried on outside of single oleo-pneumatic shock-absorber leg which retracts backwards into inner engine nacelles. Track 8.0 m. (26 ft. 3 in.). Tail-wheel retracts forward into fuselage. Different lowered positions for take-off and landing. Hutchinson tyres.

POWER PLANT.—Four Gnôme-Rhône 14-R 26-27 fourteen-cylinder two-row radial air-cooled engines each developing a normal output of 1,320 h.p. at 2,500 m. (8,200 ft.), and with 1,600 h.p. available for take-off. Two-speed superchargers. Inner engine centres to fuselage centre-line 3.5 m. (11 ft. 6 in.), inner and outer engine centres 4.1 m. (13 ft. 5½ in.). Ratier three-blade electrically-operated variable-pitch airscrews 3.80 m. (12 ft. 6 in.) diameter. Fuel capacity (80-Octane) 13,760 litres (3,027 Imp. gallons) in inter-spar wing-tanks, with 1,880 litres (414 Imp. gallons) of 100-Octane reserve, and two gravity tanks each of 200 litres (44 Imp. gallon) capacity. Total fuel capacity 16,040 litres (3,529 Imp. gallons). Four oil tanks with total capacity of 380 litres (84 Imp. gallons).

ACCOMMODATION.—Pressurized cabins. Crew of four, pilot (on port) and co-pilot/navigator side-by-side with dual controls, radio-operator (on port) and flight engineer behind. Rest-room for crew and toilet compartment immediately behind. Main fuselage can be equipped as passenger cabin with 14 seats, as 4-passenger cabin 3.16 m. (10 ft. 4½ in.) long with freight hold aft, as 8-passenger cabin 5.94 m. (19 ft. 6 in.) long with freight hold aft, or as large freight hold 7.75 m. (25 ft. 5 in.) long with capacity of 26.5 cub. m. (937 cub. ft.). Passenger chairs convertible to beds. Sliding entry door 1.4 × 1.1 m. (4 ft. 7 in. × 3 ft. 7 in.) on port side of fuselage aft of trailing-edge of wing.

EQUIPMENT.—Jaeger EJR-3 radio; Grachoir loop-aerial. L.M.T.



The S.E. 1010.

SUD-EST—*continued.*

blind-flying equipment. Photographic version has one vertical and two oblique (trimetrogen) cameras for relief mapping.

DIMENSIONS.—Span 31.0 m. (101 ft. 8½ in.), Length 21.81 m. (71 ft. 6½ in.), Height 5.2 m. (17 ft. 0 in.).

WEIGHTS AND LOADINGS (Designed).—Weight empty 14,000 kg. (30,864 lbs.), Weight loaded (photographic aircraft) 25,000-27,000 kg. (55,115-59,524 lbs.), Weight loaded (14-passenger and freight version) 33,000 kg. (72,752 lbs.), Wing loading (at 33,000 kg.= 72,752 lbs.) 283 kg./sq. m. (58 lbs./sq. ft.), Power loading (at 33,000 kg.=72,752 lbs.) 5.1 kg./h.p. (11.3 lbs./h.p.).

PERFORMANCE (Estimated).—Maximum speed 635 km.h. (395 m.p.h.) at 8,000 m. (26,250 ft.), Cruising speed 540 km.h. (335 m.p.h.) at 8,000 m. (26,250 ft.), Climb to 8,000 m. (26,250 ft.) 36 minutes, Climb to 9,000 m. (29,530 ft.) 46 minutes, Range (no wind) 7,300 km. (4,536 miles).

THE S.E. 2010.

TYPE.—Four-engined airliner.

WINGS.—Cantilever mid-wing monoplane. Structure consists of torsion-box formed by spars, hinged leading-edge, and trailing-edge carrying ailerons and slotted variable-camber flaps. Gross wing area 236 sq. m. (2,539 sq. ft.).

FUSELAGE.—Circular-section monocoque structure with Vedal stressed skin.

TAIL UNIT.—Cantilever monoplane type with dihedral tailplane. Dynamically and statically-balanced rudder and elevators, with trim and balance-tabs in each.

LANDING GEAR.—Retractable tricycle type. Each main unit carries twin wheels which retract backwards into inner engine nacelles. Nose-wheel carried in full-swivelling fork which retracts backwards into fuselage. Track 9.98 m. (32 ft. 8¾ in.).

POWER PLANT.—Four 3,500 h.p. radial air-cooled engines of unspecified type mounted on interchangeable bearers. Fuel carried in integral wing-tanks between spars.

ACCOMMODATION.—Pressurized and sound-proofed cabin seating from 60 to 160 passengers depending on range. Cabin atmosphere of 2,500 m. (8,200 ft.) maintained at 6,000 m. (19,680 ft.). Seats convertible to beds at night. Galley, bar and toilet compartments. Freight compartment under floor of passenger cabin with loading hatch and winch.

DIMENSIONS.—Span 48,95 m. (160 ft. 7 in.), Length 39.60 m. (129 ft. 10¾ in.), Height overall 11.40 m. (37 ft. 3½ in.).

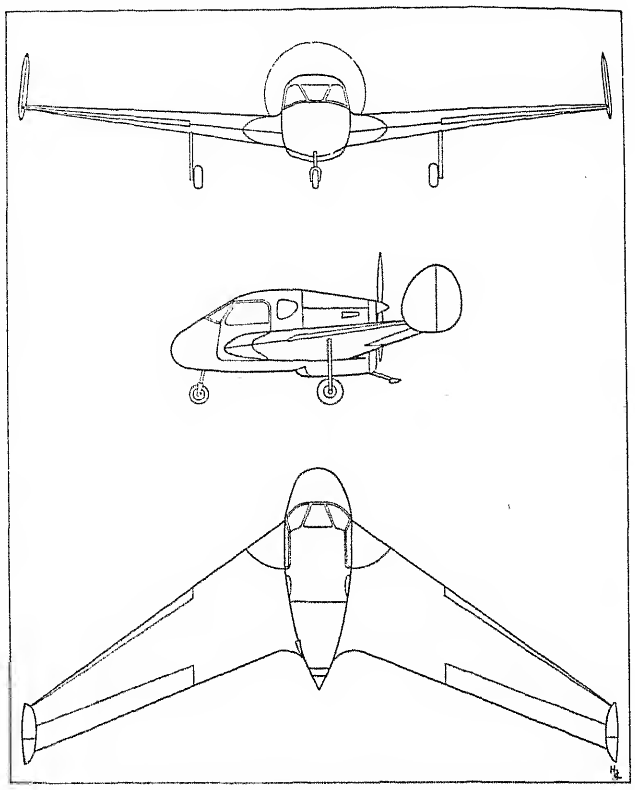
WEIGHTS AND LOADINGS (Designed).—(With 1,000 km.=621 miles range, 160 passengers and 6,400 kg.=14,110 lbs. freight).—Weight empty 30,409 kg. (67,040 lbs.), Equipment 5,127 kg. (11,303 lbs.), Fuel 6,079 kg. (13,402 lbs.), Crew 720 kg. (1,587 lbs.), Pay-load 20,000 kg. (44,092 lbs.), Weight loaded 62,335 kg. (137,424 lbs.), Wing loading 283 kg./sq. m. (58 lbs./sq. ft.), Power loading 4.3 kg./h.p. (9.5 lbs./h.p.).

WEIGHTS AND LOADINGS (Designed).—(With 1,500 km.=932 miles range, 108 passengers and 6,820 kg.=15,036 lbs. freight).—Weight empty 30,409 kg. (67,040 lbs.), Equipment 4,817 kg. (10,619 lbs.), Fuel 8,324 kg. (18,351 lbs.), Crew 720 kg. (1,587 lbs.), Pay-load 16,000 kg. (35,274 lbs.), Wing loading 255.32 kg./sq. m. (52.3 lbs./sq. ft.), Power loading 20.72 kg./h.p. (9.4 lbs./h.p.).

WEIGHTS AND LOADINGS (Designed)—(With 3,000 km.=1,846 miles range, 60 passengers and 5,600 kg.=12,346 lbs. freight).—Weight empty 30,409 kg. (67,040 lbs.), Equipment 5,633 kg. (12,418 lbs.), Fuel 15,956 kg. (35,177 lbs.), Crew 760 kg. (1,675 lbs.), Pay load 11,000 kg. (24,251 lbs.), Weight loaded 63,758 kg. (140,451 lbs.), Wing loading 270 kg./sq. m. (55.3 lbs./sq. ft.), Power loading 4.53 kg./h.p. (10 lbs./h.p.).

WEIGHTS AND LOADINGS (Designed)—(With 4,000 km.=2,487 miles range, 60 passengers and 5,600 kg. (12,246 lbs.) freight.—Weight empty 30,409 kg. (67,040 lbs.), Equipment 5,633 kg. (12,418 lbs.), Fuel 19,280 kg. (42,505 lbs.), Crew 760 kg. (1,675 lbs.), Pay load 11,000 kg. (24,251 lbs.), Weight loaded 67,082 kg. (147,889 lbs.), Wing loading 280 kg./sq. m. (57.4 lbs./sq. ft.), Power loading 4.76 kg./h.p. (10.5 lbs./h.p.).

PERFORMANCE (Estimated).—Maximum speed 570 km.h. (354 m.p.h.) at 7,500 m. (24,605 ft.), Cruising speed 437 km.h. (272 m.p.h.) at 6,000 m. (19,685 ft.), Landing speed 156 km.h. (97 m.p.h.), Maximum range 4,000 km. (2,486 miles).



The S.E. 2100 Tail-less Monoplane.

THE S.E. 2100.

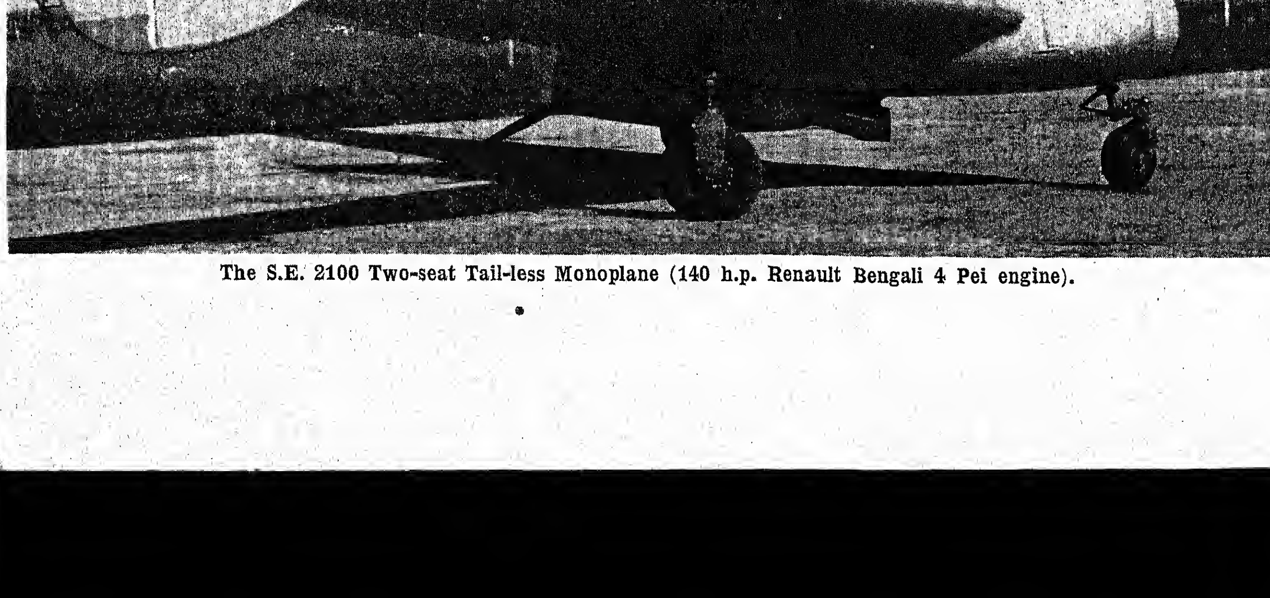
TYPE.—Two-seat tail-less Touring monoplane.

WINGS.—All-metal cantilever structure. Aerofoil section S.T. Ae.230 (Abrial-3) at root ; NACA 009 at tips. Root chord 2.32 m. (7 ft. 7¼ in.), Tip chord 0.82 m. (2 ft. 7¼ in.), Sweepback 55 degrees on leading-edge, Dihedral 10.43 degrees, Wing area 15.11 sq. m. (162.58 sq. ft.), Aileron span 3.48 m. (11 ft. 5½ in.), Aileron area (each) 0.92 sq. m. (9.9 sq. ft.). Fixed leading-edge slots. Vertical fins mounted at extremities of wings with hinged portions acting as rudders and flaps. Outward movement only. Total fin area 0.72 sq. m. (7.7 sq. ft.).

NACELLE.—All-metal monocoque structure. Length 4.2 m. (13 ft. 9½ in.), Height 1.35 m. (4 ft. 5 in.), Width 1.1 m. (3 ft. 7¼ in.), Frontal area 1.2 sq. m. (12.9 sq. ft.).

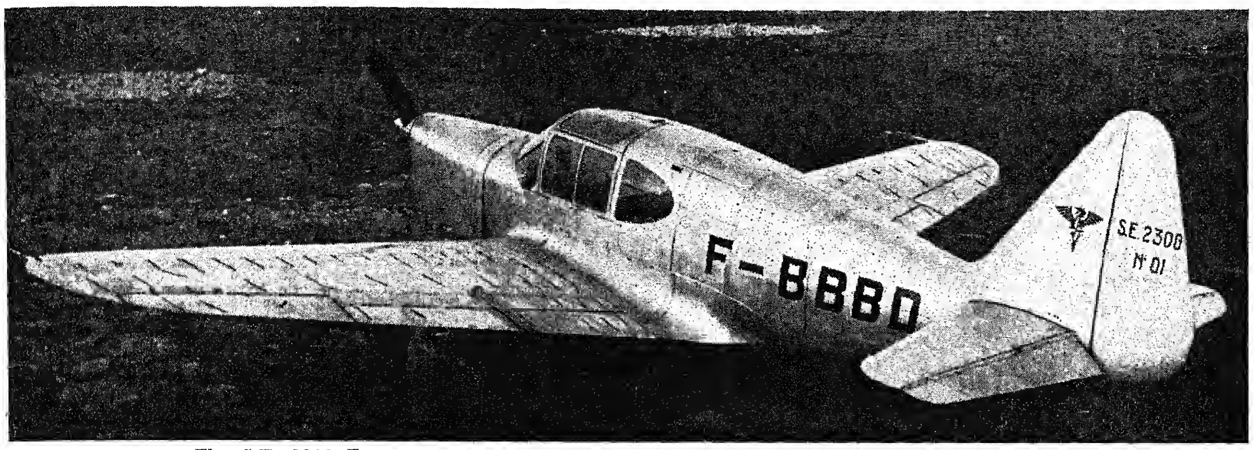
LANDING GEAR.—Fixed tricycle type. Main wheels carried on oleo-pneumatic shock-absorber legs attached to wings. Wheels 475 × 170 m/m., Travel 21 c/m. (8¼ in.). Track 3.85 m. (12 ft. 7¼ in.). Wheel base 2.44 m. (8 ft.). Brakes on main wheels. Full-swivelling nose-wheel, 355 × 150 m/m.

POWER PLANT.—One Renault Bengali 4 Pei four-cylinder in-line inverted air-cooled engine, mounted as pusher unit and developing 140 h.p. at 500 m. (1,640 ft.) at 2,400 r.p.m. Two-blade wooden



The S.E. 2100 Two-seat Tail-less Monoplane (140 h.p. Renault Bengali 4 Pei engine).

***SUD-EST**—continued.*



The S.E. 2300 Two/Three-seat Cabin Monoplane (140 h.p. Renault Bengali 4 Pei engine).

propeller 1.90 m. (6 ft. 3 in.) diameter. Fuel capacity 144 litres (31.7 Imp. gallons), Oil capacity 20 litres (4.4 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Can be arranged as single-seater with central seat. Access by large door on each side fitted with glass panels. Portion of leading-edge of wing swings when doors opened. Baggage locker 1 m. × 0.75 m. (3 ft. 3 in. × 2 ft. 6 in.) behind cabin.

DIMENSIONS.—Span 9.89 m. (32 ft. 5 in.), Length 4.92 m. (16 ft. 1½ in.), Height overall 1.89 m. (6 ft. 2 in.).

WEIGHTS AND LOADINGS.—Weight empty 518 kg. (1,142 lbs.), Useful load 282 kg. (622 lbs.), Weight loaded 800 kg. (1,764 lbs.), Wing loading 52.83 kg./sq. m. (10.82 lbs./sq. ft.), Power loading 5.7 kg./h.p. (12.6 lbs./h.p.).

PERFORMANCE.—Maximum speed 226 km.h. (140 m.p.h.), Cruising speed 198 km.h. (123 m.p.h.), Landing speed 90 km.h. (56 m.p.h.), Ceiling 5,000 m. (16,400 ft.), Range 500 km. (311 miles).

THE S.E. 2300.

TYPE.—Two/three-seat Cabin monoplane.

WINGS.—Low-wing cantilever monoplane. All-metal structuro in three main sections consisting of a centre-section built integral with fuselage and two outer sections. Main and auxiliary inverted U-shaped metal spars with bottom reinforcement over part of span, thin sheet ribs and stiffeners and formed nose-section. Electrically-welded stressed metal skin. Root chord 2.0 m. (6 ft. 6 in.), Projected tip chord 1.0 m. (3 ft. 3 in.), Dihedral 4 degrees, Gross wing area 15 sq. m. (161.4 sq. ft.). All-metal ailerons, total area 0.85 sq. m. (9.15 sq. ft.). Plain-hinge trailing-edge flaps betweon ailerons and fuselage. Total area 2.57 sq. m. (27.65 sq. ft.), Maximum depression 40 degrees.

FUSELAGE.—All-metal structure consisting of four pre-formed panels welded together. Maximum depth 1.45 m. (4 ft. 7¼ in.), Maximum width 1.15 m. (3 ft. 8¼ in.).

TAIL UNIT.—All-metal cantilever monoplane type. Fin area 0.74 sq. m. (7.96 sq. ft.), Rudder area 0.98 sq. m. (10.54 sq. ft.), Tailplane area 1.80 sq. m. (19.36 sq. ft.), Elevator area 1.20 sq. m. (12.91 sq. ft.), Tailplane span 4.21 m. (13 ft. 9½ in.).

LANDING GEAR.—Fixed two-wheel divided type. Each main wheel 475 × 170 m/m., carried on single spatted oleo-pneumatic leg, travel 22.5 cm. (8¾ in.). Full-swivelling tailwheel, 280 × 90 m/m., carried on sprung leg, with 21.5 cm. (8¾ in.) travel. Track 2.87 m. (9 ft. 5 in.).

POWER PLANT.—Ono Renault Bengali 4 Pei four-cylinder in-line inverted air-eooled engine developing 140 h.p. at 2,400 r.p.m. and flexibly-mounted on two Y-shaped bearers bolted to fire-proof bulkhead. Two blade wooden airscrew 1.90 m. (6 ft. 3 in.) diameter. Fuel tank in fuselago.

ACCOMMODATION.—Enclosed cabin seating two side-by-sido with dual controls, with provision for third oceupant aft. Moulded windscreen. Access door and transparent rear-view panels on each side. Luggage compartment aft of eabin.

EQUIPMENT.—Full blind-flying and radio equipment.

DIMENSIONS.—Span 10.13 m. (33 ft. 3 in.), Length 7.40 m. (24 ft. 3½ in.), Height 2.11 m. (6 ft. 11 in.).

WEIGHTS AND LOADINGS.—Weight empty (equipped) 685 kg. (1,510 lbs.), Fuel 140 kg. (309 lbs.), Two passengers 160 kg. (353 lbs.), Baggage 30 kg. (66 lbs.), Weight loaded 1,015 kg. (2,238 lbs.), Wing loading 67 kg./sq. m. (13.72 lbs./sq. ft.), Power loading 7.2 kg./h.p. (15.87 lbs./h.p.).

PERFORMANCE.—Maximum speed 235 km.h. (146 m.p.h.), Cruising speed 212 km.h. (132 m.p.h.), Landing speed 75 km.h. (47 m.p.h.), Ceiling 4,650 m. (15,255 ft.), Range 900 km. (559 miles), Landing distance from 8 m. (26 ft.), (with flaps) 300 m. (328 yds.), (without flaps) 360 m. (394 yds.).

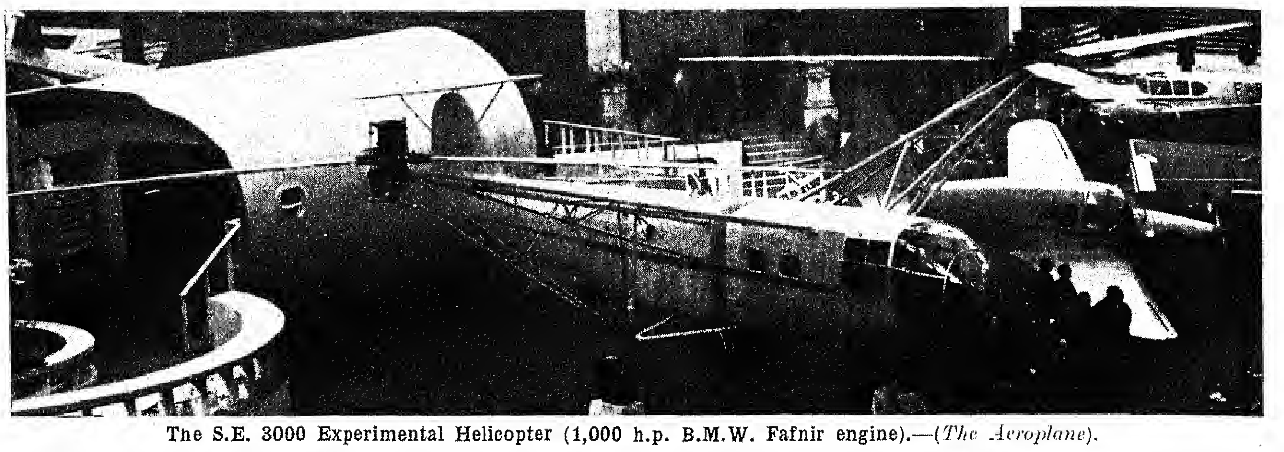
THE S.E. 2310.

The S.E. 2310 is a variation of the S.E. 2300 and is identical to it except that the third seat is fitted as standard, and a tricycle undercarriage replaces the two-wheel landing gear. All the wheels are 355 × 150 m/m., and the legs have a travel of 6.3 in. (16 c/m.). The track remains as on the S.E. 2300 and the wheel base is 1.94 m. (6 ft. 4 in.).

WEIGHTS AND LOADINGS.—Weight empty (equipped) 700 kg. (1,543 lbs.), Fuel 112 kg. (247 lbs.), Three passengers 240 kg. (529 lbs.), Baggage 30 kg. (66 lbs.), Weight loaded 1,082 kg. (2,385 lbs.), Wing loading 72 kg./sq. m. (14.75 lbs./sq. ft.), Power loading 7.7 kg./h.p. (16.97 lbs./h.p.).

The S.E. 2310 Three-seat Cabin Monoplane, a tricycle version of the S.E. 2300.

SUD-EST—*continued.*



The S.E. 3000 Experimental Helicopter (1,000 h.p. B.M.W. Fafnir engine).—(*The Aeroplane*).

PERFORMANCE.—Maximum speed 225 km.h. (140 m.p.h.), Cruising speed 205 km.h. (127 m.p.h.), Landing speed 75 km.h. (47 m.p.h.), Range 900 km. (559 miles), Ceiling 4,650 m. (15,255 ft.), Landing distance from 8 m. (26 ft.), (with flaps) 230 m. (252 yds.), (without flaps) 300 m. (328 yds.).

THE S.E.3000.

The S.E.3000 is a twin-rotor six-seat commercial helicopter developed from the German Focke-Achgelis Fa 223 with the co-operation of Professor H. Focke, who is now employed with the S.E. Company. The S.E.3000 has a welded steel-tube fuselage with cantilever outriggers extending outward and upward from each side of the fuselage to carry the twin three-blade rotors. The power plant consists of a B.M.W. Bramo Fafnir fourteen-cylinder two-row radial air-cooled engine mounted in the fuselage and developing a normal output of 720 h.p. and a maximum output of 1,000 h.p. for take-off.

The tail-unit consists of a cantilever fin and rudder on which is mounted a horizontal tailplane strut-braced to the fin. The landing gear is of the fixed tricycle type, the main wheels carried on cantilever shock-absorber legs extending from the outriggers, and the nose-wheel carried in a fork under the fuselage.

The crew of two is accommodated in the nose of the fuselage in a fully-glazed cockpit, with the four-passenger cabin behind.

DIMENSIONS.—Overall width 24.50 m. (80 ft. 4½ in.), Length 12.80 m. (41 ft. 7¼ in.), Height 4.80 m. (15 ft. 8½ in.), Total rotor disc area 226.2 sq. m. (2,434 sq. ft.).

WEIGHTS.—Weight empty 3,176 kg. (7,002 lbs.), Disposable load. 1,108 kg. (2,443 lbs.), Weight loaded 4,284 kg. (9,445 lbs.).

PERFORMANCE.—Maximum speed 182 km.h. (113 m.p.h.), Rate of climb 480 m./min. (1,575 ft./min.), Vertical ceiling 4,000 m. (13,125 ft.), Oblique ceiling 7,000 m. (22,965 ft.), Range 370 km. (230 miles).

SUD-OUEST.

SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DE SUD-OUEST (S.N.C.A.S.O).

HEAD OFFICE: 105, AVENUE RAYMOND-POINCARÉ, PARIS (16e).

WORKS: COURBEVOIE, SURESNES (TWO), VILLACOUBLAY, NANTES, ROCHEFORT, CHATEAUROUX-DÉOLS, BORDEAUX, CHATILLON-SOUS-BAGNEUX, ISSY-LES-MOULINEAUX, BOUGUENAIS, SAINT-NAZAIRE AND CANNES.

Director-General: M. Avenet.

The Société Nationale de Constructions Aéronautiques de Sud-Ouest was formed in 1936 under the Nationalisation Laws. It embraced factories which formerly belonged to the Marcel Bloch, Blériot and Lioré-et-Olivier companies. In 1941 the S.N.C.A. de l'Ouest was merged into the S.N.C.A.S.O. bringing in factories of the former Breguet and Loire-Nieuport companies.

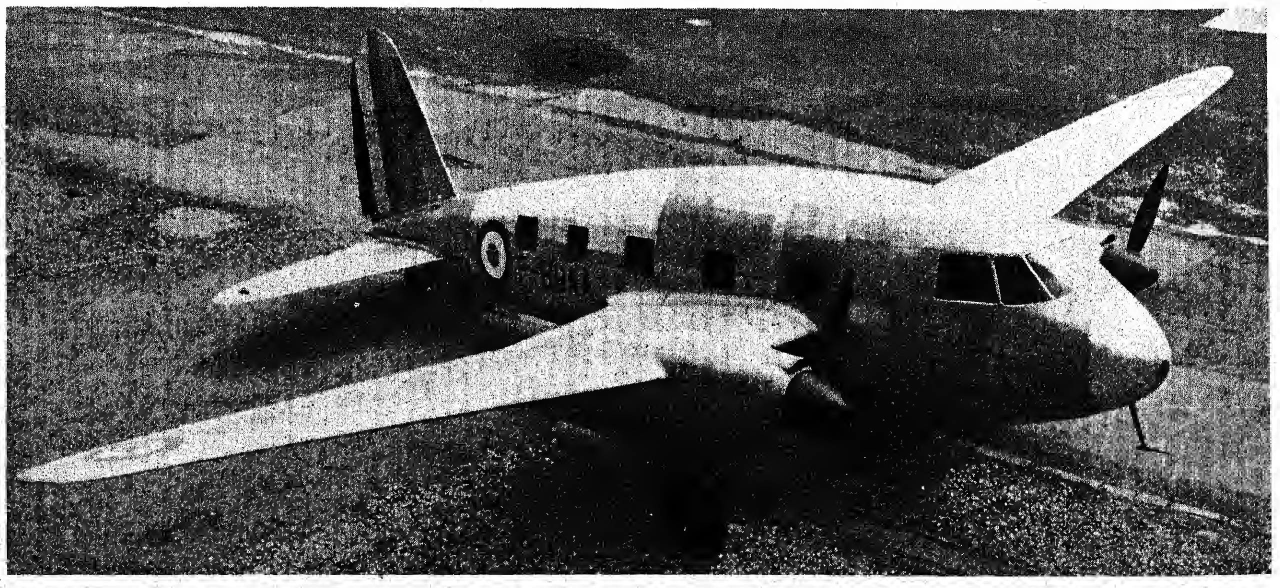
After the Franco-German Armistice in June, 1940, only one S.N.C.A.S.O. factory, that at Chateauroux, remained outside the occupied zone and until the complete occupation of France this factory operated under the orders of the Vichy Government.

In August, 1940, a group of S.N.C.A.S.O. engineers and technicians from various factories in the occupied zone established themselves at Chateauroux and this group, augmented by other volunteers, moved to Cannes in May, 1941, where as the Groupe Technique de Cannes, it developed and built a number of interesting prototypes. These included the S.O. 90 and the S.O. 30N and 30R, the prototypes of aircraft which are now in production by the S.N.C.A.S.O.

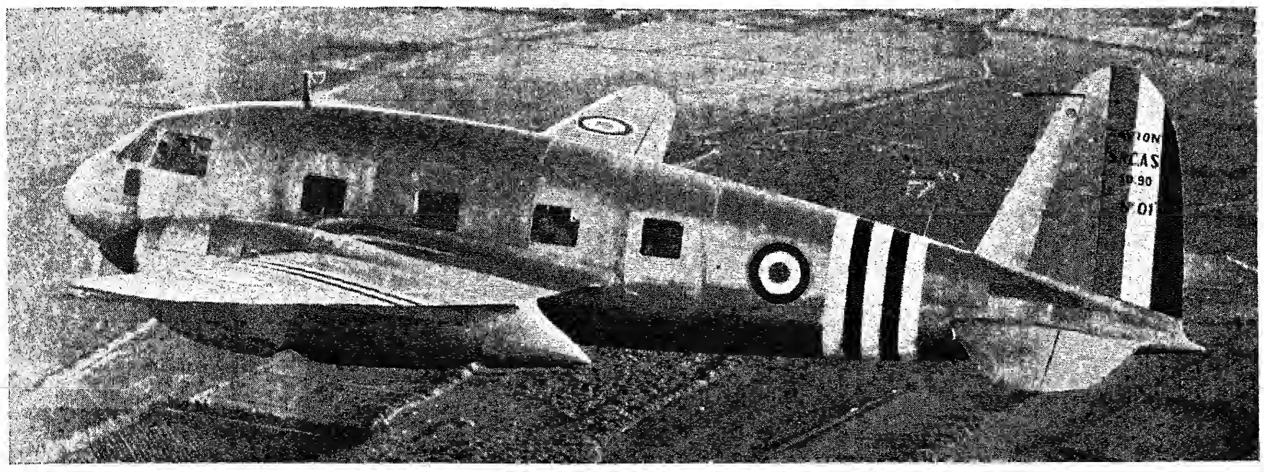
The S.O. 90 made a dramatic first flight. Piloted by M. Hurel, one of the design engineers of the Groupe Technique de Cannes, and carrying nine passengers it took off under the noses of members of the Italo-German Armistice Commission, ostensibly on a local test, and flew to Algiers, in North Africa. After this episode the flying of all prototypes was forbidden to prevent further escapes.

The prototype of the S.O. 30N was completed in November, 1942, but test flights were prohibited.

Another notable type developed by the S.N.C.A.S.O. was the S.O. 161 (formerly the Bloch 161). The prototype was completed and flown at Bordeaux in 1939 but the occupational authorities would not permit the aircraft to fly to Marignane to complete its tests until January, 1942. In June of that year the Vichy Government ordered a series of this aircraft from the S.N.C.A. Sud-Est but none was completed before the liberation of France. This aircraft, now known as the S.E. 161 Languedoc,



The S.O. 90 Light Transport Monoplane, the prototype of the S.O. 93, 94 and 95.



The S.O. 90 Light Transport Monoplane (two 580 h.p. Renault 12 S OO engines).

is in production in the Toulouse factory of the S.N.C.A.S.E. (which see).

Several interesting projects are under development, including the S.O. 6000 jet-propelled aircraft, five of which have been ordered. The first will be fitted with a Junkers Jumo 004 axial-flow turbo-jet and the others will have Rateau-Gnôme and Rolls-Royce turbo-jets. Other projects include the S.O. 177 reconnaissance version of the S.O. 175 powered by two Hispano-Suiza 12Y31 twelve-cylinder liquid-cooled engines; and the S.O. 8000 long-range fighter.

Sub-contract work in progress by S.O. includes tail-units for the S.E.2000 four-engined transport; fuselages for the Morane-Saulnier MS.472; components for the A.A.C.1 (Junkers Ju 52 3/m.) and three centre-sections for the Latecoere 631. S.O. is also to assemble three of these flying boats at St. Nazaire.

THE SUD-OUEST S.O. 93, 94 AND 95.

The S.O. 93 and 94 are the current production versions of the S.O. 90 referred to above. These two aircraft differ only with regard to the disposable load carried, the S.O. 93 carrying eight passengers or 1,200 kg. (2,640 lbs.) of freight and the S.O. 94 ten passengers or 2,000 kg. (4,400 lbs.) of freight. The S.O. 95 is a postal version with a normal two-wheel landing-gear and a disposable load of 1,500 kg. (3,300 lbs.). Its loaded weight is 5,600 kg. (12,320 lbs.).

Type.—Twin-engined Light Commercial monoplane.

Wings.—Mid-wing cantilever monoplane. Wing in two main sections each attached to the fuselage by three quick-detachable fittings. All-metal two-spar girder structure with detachable leading-edge. Entire trailing-edge hinged, inner sections acting as flaps and outer sections as ailerons. Gross wing area (S.O. 93) 32 sq. m. (334.3 sq. in.), (S.O. 94) 32.6 sq. m. (350.7 sq. ft.).

Fuselage.—Oval section metal monocoque. Structure consists of a series of U-section frames and L-section stringers, the whole covered with a smooth skin. Girder type frames in the planes of the wing spars.

Tail Unit.—Cantilever monoplane type. Metal-covered fixed surfaces and metal-framed fabric-covered movable surfaces. Automatic and electrically-controllable trim-tabs in elevators.

Landing Gear.—Retractable tricycle type. Main wheels retract forward into engine nacelles, nose wheel backwards into fuselage. Hydraulic actuation. Hydraulic brakes on all wheels.

Power Plant.—Two 580 h.p. Renault 12 S OO twelve-cylinder inverted Vee air-cooled engines, driving three-blade constant-speed full feathering airscrews. Fuel system in two interconnected groups, one for each engine. Total fuel capacity 980 litres (216 Imp. gallons).

Accommodation.—Pilot's compartment seats two side-by-side with dual controls. Main cabin of 12 cub. m. (424 cub. ft.) (S.O.93) or 13 cub. m. (459 cub. ft.) (S.O. 94) capacity. Internal accommodation suited to purchaser's requirements. Passenger version may carry eight (S.O. 93) or ten (S.O. 94) persons, with lavatory forward and baggage compartment aft of cabin. Soundproofing, ventilation and heating. With seats removed cabin may be used for cargo or postal purposes.

Equipment.—24-volt electric system. Radio, automatic pilot, thermal de-icing, night-flying and blind-flying equipment, etc.

Dimensions (S.O. 93).—Span 16 m. (52 ft. 6 in.), Length 12 m. (39 ft. 4 in.), Height (over tail) 4.39 m. (14 ft. 5 in.).

Dimensions (S.O. 94).—Span 16.181 m. (53 ft.), Length 12.35 m. (40 ft. 6 in.), Height (over tail) 4.39 m. (14 ft. 5 in.).

Weights (S.O. 93).—Weight empty 3,300 kg. (7,260 lbs.), Fuel and oil 550 kg. (1,210 lbs.), Crew 150 kg. (330 lbs.), Disposable load 1,200 kg. (2,640 lbs.), Weight loaded 5,200 kg. (11,440 lbs.).

Weights (S.O. 94).—Weight empty 3,500 kg. (7,700 lbs.), Fuel and oil 550 kg. (1,210 lbs.), Crew 150 kg. (330 lbs.), Disposable load 2,000 kg. (4,400 lbs.), Weight loaded 6,200 kg. (13,640 lbs.).

Performance (S.O. 93).—Maximum speed 450 km.h. (279.4 m.p.h.) at 2,400 m. (7,870 ft.), Cruising speed 375 km.h. (232.8 m.p.h.) at 2,600 m. (8,530 ft.), Service ceiling 7,500 m. (24,600 ft.), Service ceiling on one engine 4,000 m. (13,120 ft.), Take-off run to clear 20 m. (65.6 ft.) obstacle at fully-loaded weight 475 m. (519 yds.).

Performance (S.O. 94).—Maximum speed 445 km.h. (276.3 m.p.h.) at 2,400 m. (7,870 ft.), Cruising speed 375 km.h. (232.8 m.p.h.) at 2,600 m. (8,530 ft.), Service ceiling as for S.O. 93, Take-off run to clear 20 m. (65.6 ft.) obstacle at fully-loaded weight 680 m. (743 yds.)

THE SUD-OUEST S.O. 30R BELLATRIX.

The S.O. 30R is the production version of the S.O. 30N prototype which was designed and built during the war by the Group Technique de Cannes.

Type.—Twin-engined Airliner.

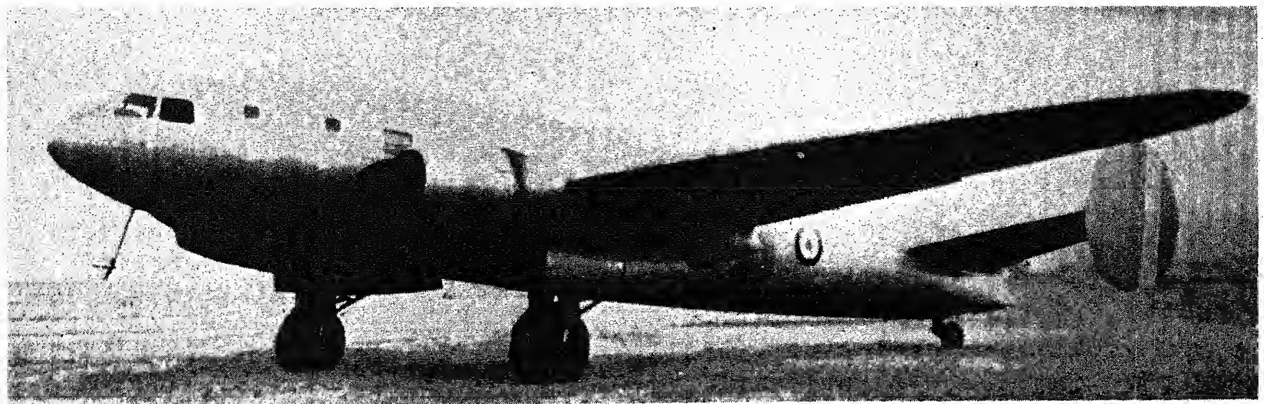
Wings.—Mid-wing cantilever monoplane. Each half wing comprises an inner section carrying one engine nacelle and half the main landing-gear, and two outer sections. All-metal structure with a two-spar central girder, a detachable leading-edge and a hinged trailing-edge forming the hydraulically-operated flaps and the ailerons. Aspect ratio 7.99. Gross wing area 82 sq. m. (882.3 sq. ft.).

Fuselage.—Circular section all-metal monocoque made up of frames, stringers and a riveted smooth metal skin. The pilot's compartment, passenger cabin, buffet and toilets and the three baggage compartments beneath the cabin floor are pressurised and all skin joints are sealed with rubber.

Tail Unit.—Cantilever monoplane type. All-metal structure. Trim-tabs in elevators and rudder.

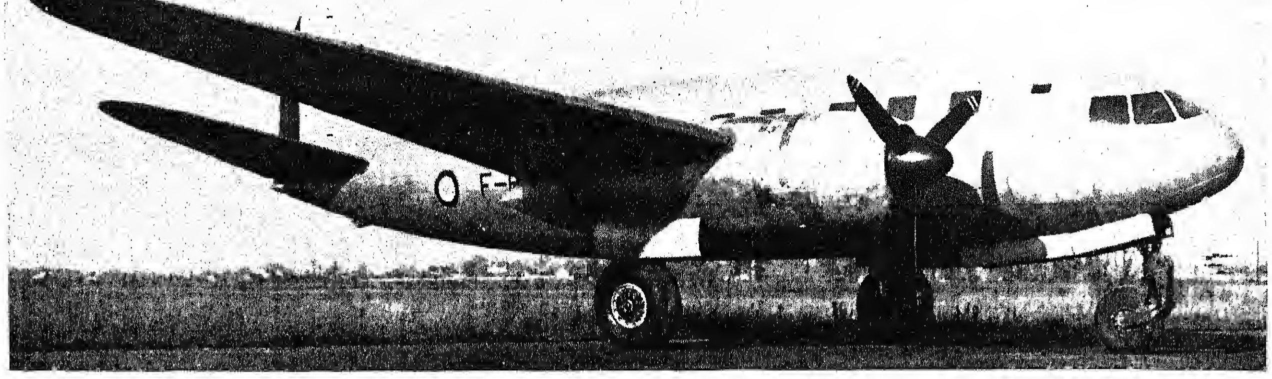
Landing Gear.—Retractable tricycle type. Main wheels raised forward into engine nacelles, nose wheel backward into fuselage. Hydraulic actuation. Hydraulic brakes on all wheels.

Power Plant.—Two Gnôme-Rhône 14 R.5 fourteen-cylinder two-row air-cooled radial engines with two-speed superchargers, each normally rated at 1,295 h.p. and with 1,700 h.p. available for take-off.



The S.O. 30N built by the Groupe Technique de Cannes during the War. It was the prototype of the Sud-Ouest S.O. 30R Bellatrix.

SUD-OUEST*—continued.*



The S.O. 30R Bellatrix Twin-engined Passenger Monoplane (two 1,700 h.p. Gnôme-Rhône 14 R5 engines).

Engines mounted elastically on steel-tube mountings in quickly detachable nacelles. Entire cowling hinged in three panels for easy access to entire installation. Ratier three-blade electrically operated constant-speed airscrews 3.7 m. (12 ft. 2 in.) in diameter. Fuel system in two interconnected groups, one for each engine. Total fuel capacity 3,800 litres (836 Imp. gallons.)

ACCOMMODATION.—Crew consists of one or two pilots, engineer, radio operator and steward. Passenger accommodation divided into three compartments. For day flying these compartments may seat a maximum of nine, six and fifteen passengers repectively. For night flying sixteen berths may be provided. Cabins and crew compartment are sound-proofed and air-conditioned. Entrance vestibule, toilet and buffet aft of cabin. Three baggage compartments with external access beneath cabin floor. A further baggage hold in rear portion of fuselage aft of pressurized portion and two additional compartments in the inner wing sections with access doors beneath the wings.

DIMENSIONS.—Span 25.610 m. (84 ft.), Length 18.40 m. (60 ft. 4 in.), Height (over tail) 5.90 m. (19 ft. 4 in.).

WEIGHTS (Day plane, 30 passengers, 2,000 km.=1,242 miles range).—Weight empty (with equipment) 9,870 kg. (21,714 lbs.), Fuel and oil (2,000 km.—1,242 mile range) 1,970 kg. (4,334 lbs.), Reserve fuel and oil 985 kg. (2,170 lbs.), Crew 320 kg. (704 lbs.), Passengers (30) and hand baggage 2,550 kg. (5,610 lbs.), Mail or freight 705 kg. (1,550 lbs.), Total pay load 3,255 kg. (7,160 lbs.), Loaded weight 16,400 kg. (36,080 lbs.), Landing weight 14,430 kg. (31,746 lbs.).

WEIGHTS (Sleeper, 16 passengers, 3,000 km.=1,863 miles range).—Weight empty 9,870 kg. (21,714 lbs.), Fuel and oil 2,850 kg. (6,270 lbs.), Crew 400 kg. (880 lbs.), Passengers (16) and hand baggage 1,360 kg. (2,992 lbs.), Mail or freight 1,800 kg. (3,960 lbs.), Total pay load 3,160 kg. (6,950 lbs.), Weight loaded 16,390 kg. (36,060 lbs.), Landing weight 13,740 kg. (30,230 lbs.).

PERFORMANCE.—Maximum speed at sea level 436 km.h. (270 m.p.h.), Maximum speed at 7,700 m. (25,260 ft.) 545 km.h. (338.4 m.p.h.). Cruising speed (54% power) at 6,000 m. (19,680 ft.) 440 km.h. (273.2 m.p.h.), Rate of Climb at 2,450 m. (8,040 ft.) 366 m./min. (1,200 ft./min.), Service ceiling (at 15,000 kg.=33,069 lbs. loaded weight) 8,450 m. (27,720 ft.), Service ceiling on one engine (at 15,000 kg.= 33,069 lbs. loaded weight) 3,000 m. (9,840 ft.), Take-off run to clear 15 m. (50 ft.) obstacle (at 16,400 kg.=36,080 lbs. loaded weight) 910 m. (995 yds.).

THE S.O. G.L.3 LIBELLULE (DRAGONFLY).

The Libellule is a two-seat twin-beom pusher monoplane for sporting flying and is powered by a 40-45 h.p. Praga B2 four-cylinder horizontally-opposed air-cooled engine mounted at the rear of the nacelle and driving a two-blade fixed-pitch wooden propeller.

The Libellule is a cantilever high-wing monoplane of wooden construction with a twin-fin tail-unit and a non-retractable landing gear.

DIMENSIONS.—Span 13 m. (42 ft. 7 in.), Length 7.5 m. (24 ft. 7 in.), Wing area 20 sq. m. (215.2 sq. ft.).

WEIGHT AND LOADINGS.—Weight loaded 550 kg. (1,213 lbs.), Wing loading 27.5 kg./sq. m. (5.6 lbs./sq. ft.), Power loading 12.2 kg./h.p. (5.52 lbs./h.p.).

PERFORMANCE (Estimated).—Maximum speed 129 km.h. (80 m.p.h.), Cruising speed 109 km.h. (68 m.p.h.), Range 440 km. (273 miles).

THE S.O. M1.

The S.O. M1 is an experimental jet-propelled monoplane produced for research purposes and is to form the prototype of the projected S.O.4000 jet-propelled bomber. It is a mid-wing monoplane of all-metal construction, with sharply tapered and swept-back wings and tail-unit.

It is to be built in three versions; one a glider, (which had been completed at the time of writing); one powered by a Walter HWK 509A liquid-fuel rocket unit, and one with a Rolls-Royce Derwent V centrifugal-flow jet-unit developing a static thrust of 1,361 kg. (3,000 lbs.). Retractable two-wheel and tricycle undercarriages will be fitted experimentally.

DIMENSIONS.—Span 8.93 m. (29 ft. 3½ in.), Length 9 m. (29 ft. 6¼ in.), Wing area 17.25 sq. m. (185.6 sq. ft.).

WEIGHTS AND LOADING (Designed).—Maximum weight loaded 4,700 kg. (10,361 lbs.), Wing loading 272 kg./sq. m. (42.8 lbs./sq. ft.).

PERFORMANCE (Estimated).—Maximum speed 890 km.h. (559 m.p.h.).

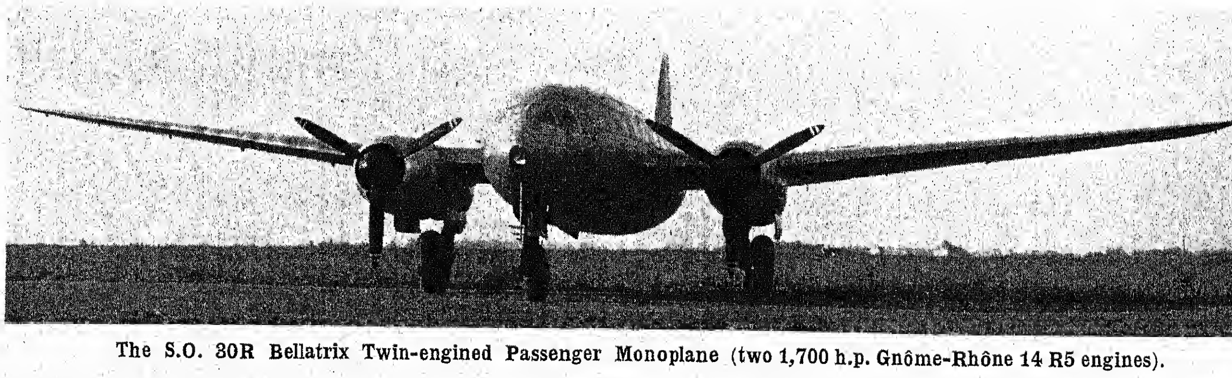
THE S.O. (BLOCH) 175.

The S.O.175 is a twin-engined three-seat reconnaissance bomber developed from and resembling the Blech 174 all-metal low-wing bomber which was briefly mentioned in the 1939 edition of "All the World's Aircraft." One hundred S.O.175 are in production. The new aircraft is powered by two Gnôme-Rhône N 48/N 49 fourteen-cylinder two-row radial air-cooled engines each rated at 1,015 h.p. at 2,400 r.p.m. at 4,200 m. (13,780 ft.) and driving Chauvière three-blade variable-pitch airscrews. The fuel capacity of 2,010 litres (422 Imp. gallons) is contained in eight wing tanks, and there is provision for an auxiliary long-range tank of 550 litres (121 Imp. gallons) capacity in the bomb-bay. The two-wheel retractable landing gear has a track of 4.09 m. (13 ft. 5 in.).

DIMENSIONS.—Span 17.96 m. (58 ft. 11 in.), Length 12.43 m. (40 ft. 9 in.), Height 3.60 m. (11 ft. 9½ in.), Wing area 42.42 sq. m. (456.6 sq. ft.), Aspect ratio 7.6.

WEIGHTS AND LOADINGS.—Weight empty 4,710 kg. (10,383 lbs.), Maximum disposable load 3,313 kg. (7,304 lbs.), Weight loaded 8,023 kg. (17,687 lbs.), Wing loading 189 kg./sq. m. (38.16 lbs./sq. ft.), Power loading 3.95 kg./c.v. (8.8 lbs./h.p.).

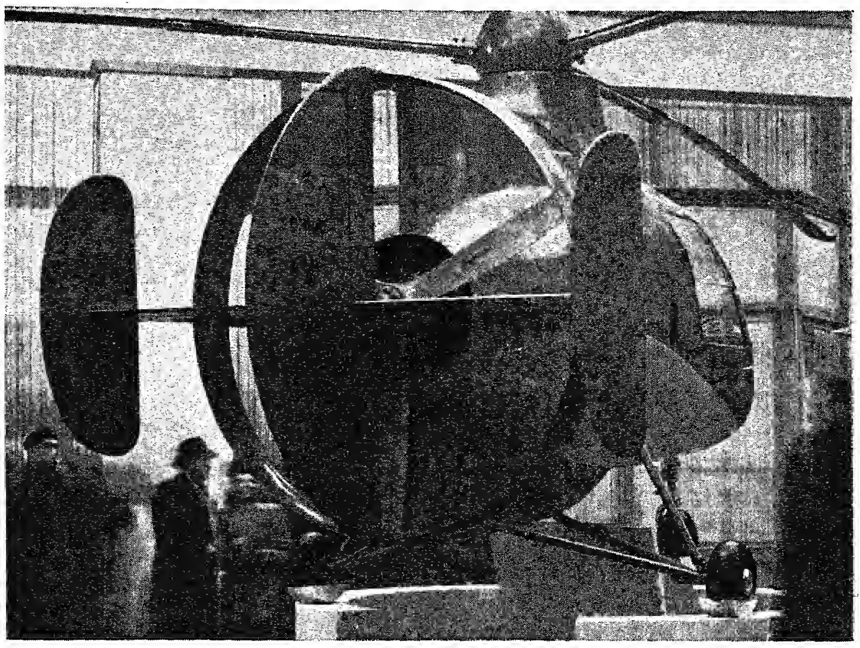
PERFORMANCE.—Maximum speed 510 km.h. (317 m.p.h.) at 5,200 m. (17,060 ft.), Landing speed 110 km.h. (68 m.p.h.), Climb to 8,000 m. (26,245 ft.) at 6,500 kg. (14,330 lbs.) 13½ minutes, Service ceiling 10,300 m. (33,790 ft.) at 7,500 kg. (16,534 lbs.), or 11,000 m. (36,090 ft.) at 6,800 kg. (14,992 lbs.), Range 3,300 km. (2,050 miles).



The S.O. 30R Bellatrix Twin-engined Passenger Monoplane (two 1,700 h.p. Gnôme-Rhône 14 R5 engines).

***SUD-OUEST**—continued.*

THE S.O. 1100 ARIEL.



The S.O. 1100 Experimental Rotating-wing Aircraft.—(*The Aeroplane*).

The S.O.1100 is a two-seat rotating-wing aircraft which combines the principles of both the helicopter and the Autogiro. The fuselage consists of a short oval all-metal structure with a 170 h.p. Mathis G7R seven-cylinder radial air-cooled engine mounted at the rear, driving a three-blade fixed-pitch wooden propeller and acting as a compressor to drive the main three-blade rotor. The main rotor is mounted above the fuselage and is fitted with jet outlets at the tips of the blades. It rotates at 300 r.p.m.

The tail-unit of the prototype aircraft consists of a triple fin and rudder structure, the outer fins of which are to be deleted on subsequent aircraft. The landing gear is a non-retractable tricycle.

The crew of two is accommodated in a fully-glazed cabin in the nose.

Dimensions.—Main rotor diameter 10 m. (32 ft. 9½ in.), Length of fuselage 4.20 m. (13 ft. 9½ in.), Rotor disc area 78.5 sq. m. (844.66 sq. ft.).

Weights.—Weight empty (equipped) 524 kg. (1,155 lbs.), Pilot and passenger 176 kg. (388 lbs.), Fuel and oil 70 kg. (154 lbs.), Weight loaded 770 kg. (1,697 lbs.).

Performance.—Cruising speed 150 km.h. (93 m.p.h.), Range 200 km. (124 m.p.h.).

THE S.O. 3050.

Type.—Two-seat cabin monoplane.

Wings.—Cantilever low-wing monoplane. All-metal single box-spar structure with detachable leading-edge and rounded tips. Full-span ailerons which act also as variable-camber landing flaps. Aspect ratio 7.5. Wing area 10.5 sq. m. (113 sq. ft.).

Fuselage.—Semi-monocoque structure in two sections.

Tail Unit.—Cantilever monoplane type of metal construction.

Landing Gear.—Fixed tricycle type. Track 2 m. (6 ft. 6½ in.).

Power Plant.—One 140 h.p. Renault Bengali 4 Pei four-cylinder in-line inverted air-cooled engine driving Merville two-blade fixed-pitch wooden airscrew. Fuel capacity 110 litres (24 Imp. gallons), Oil capacity 10 litres (2.2 Imp. gallons).

Accommodation.—Enclosed cabin seating two side-by-side with dual controls.

Dimensions.—Span 9.20 m. (30 ft. 2 in.), Length 7.08 m. (23 ft. 3 in.), Height 2.3 m. (7 ft. 3½ in.).

Weights and Loadings.—Weight empty 556 kg. (1,226 lbs.), Payload 190 kg. (419 lbs.), Fuel and oil 89 kg. (196 lbs.), Disposable load 279 kg. (615 lbs.), Weight loaded 835 kg. (1,841 lbs.), Wing loading 79.5 kg./sq. m. (16.3 lbs./sq. ft.), Power loading 5.97 kg./h.p. (13.2 lbs./h.p.).

Performance.—Maximum speed 250 km.h. (156 m.p.h.) at sea level, Cruising speed (70% Power) 220 km.h. (137 m.p.h.), Landing speed 60 km.h. (37 m.p.h.), Rate of climb at sea level 270 m./min. (886 ft./min.), Climb to 1,000 m. (3,280 ft.) 4 minutes, Service ceiling 5,000 m. (16,405 ft.), Range 700 km. (435 miles), Take-off run (11 seconds) 200 m. (220 yds.), Take-off distance to 8 m. (26 ft.) 250 m. (273 yds.).

THE S.O. 6000.

The S.O.6000 is a two-seat side-by-side jet-propelled monoplane for advanced training duties. It is an all-metal cantilever mid-wing monoplane with constant taper in chord and thickness from root to tip, and a cantilever monoplane tail-unit. The wing is a single-spar structure built in two sections and set at an acute dihedral angle. Trailing-edge flaps are fitted between ailerons and fuselage.

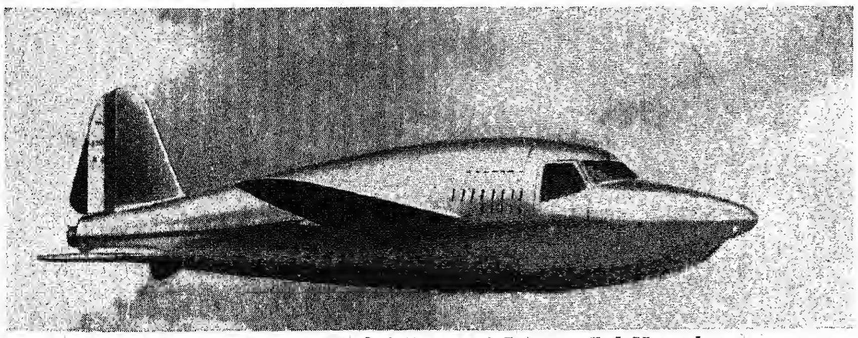
The fuselage is of circular cross-section and is constructed in three sections, the jet-unit being installed in the centre-section. The air-intake is in the nose, with the jet outlet in the extreme stern under the rudder. The prototype aircraft, (S.O.6000J) which first flew on November 11, 1946, is powered by a Junkers Jumo 004 B-2 jet-unit, while other versions will be fitted with the Rateau GTS 65 (S.O.6000R); the Rolls-Royce Derwent V (S.O.6000D) developing a static thrust of 1,587 kg. (3,500 lbs.), and the Rolls-Royce Nene (S.O.6000N) of 2,266 kg. (5,000 lbs.) static thrust.

A retractable tricycle landing gear is fitted, the main wheels carried on shock-absorber legs attached to the wing and retracting into the fuselage, and the nose-wheel retracting rearwards into the forward section of the fuselage. The track is 5.16 m. (16 ft. 11 in.) and the wheel base 3.63 m. (11 ft. 11 in.).

Dimensions.—Span 9.16 m. (30 ft.), Length 10.48 m. (34 ft. 4½ in.), Wing area 14 sq. m. (150.64 sq. ft.).

Weights and Loading.—Weight empty 2,293 kg. (5,060 lbs.), Weight loaded 4,000 kg. (8,818 lbs.), Wing loading 285 kg./sq. m. (48.36 lbs./sq. ft.).

Performance.—Maximum speed 950 km.h. (590 m.p.h.), Landing speed 150 km.h. (93 m.p.h.).



A Drawing of the S.O. 6000 Two-seat Jet-propelled Monoplane.

THE S.O. 7010 PÉGASE.

The S.O.7010 is a twin-engined light transport monoplane with accommodation for six passengers and a crew of two. It is a cantilever low-wing aircraft with a single fin and rudder, and the power plant consists of two 180-200 h.p. Mathis G8R eight-cylinder inverted vee air-cooled engines mounted together (G. 16R) in the nose to drive a single three-blade variable-pitch airscrew, 2.56 m. (8 ft. 5 in.) diameter.

The S.O.7010 is of all-metal construction, including the covering of the control surfaces. The wing structure consists of a centre-section and two outer wings, with detachable tips. Slotted flaps are fitted between the ailerons and the fuselage.

The landing gear is a retractable tricycle consisting of main wheels carried on the outside of Messier shock-absorber legs retracting inwards into the fuselage, and a nose-wheel rearwards into the fuselage. The track is 2.84 m. (9 ft. 4 in.) and the wheel base 3.364 m. (11 ft.).

The cabin accommodates the pilot (on port) with a co-pilot or other crew member beside him, who can be replaced by one passenger on short flights, and six passengers aft on two full-width seats. There is an access door on each side of the fuselage. Various interior arrangements permit the S.O.7010 to be used also for executive, ambulance or freight-carrying duties.

Dimensions.—Span 14.70 m. (48 ft. 2¼ in.), Length 11.12 m. (36 ft. 4¾ in.), Wing area 33 sq. m. (355 sq. ft.).

Weights and Loadings (Designed).—Weight empty 1,807 kg. (3,984 lbs.), Disposable load 1,097 kg. (2,418 lbs.), Weight loaded 2,904 kg. (6,402 lbs.), Wing loading 88 kg./sq. m. (18 lbs./sq. ft.), Power loading 7.2 kg./h.p. (15.87 lbs./h.p.).

Performance (Estimated).—Maximum speed 325 km.h. (202 m.p.h.), Cruising speed 300 km.h. (186 m.p.h.), Cruising speed on one engine 170 km.h. (106 m.p.h.) at 2,000 m. (6,560 ft.), Ceiling 5,000 m. (16,405 ft.), One-engine ceiling 1,000 m. (3,280 ft.), Maximum range (with six passengers and 60 kg. = 132 lbs. freight) 1,250 km. (777 miles), Take-off distance to 20 m. (66 ft.) 460 m. (503 yds).

ITALY

A.V.I.A.

AZIONARIA VERCELLESE INDUSTRIE AERONAUTICHE.

HEAD OFFICE : VERCELLI.

This firm has produced the F.L.3 two-seat low-wing monoplane intended for touring and training purposes. A brief description of this aircraft follows.

THE A.V.I.A. F.L.3.

The F.L.3 is a cantilever low-wing monoplane of wooden construction and has accommodation for a pilot and passenger side-by-side in an enclosed cabin. The wing is a two-spar tapered structure of NACA 23012 aerofoil section and is ply-covered. The tail-unit is a cantilever monoplane structure with plywood and fabric covering. A fixed two-wheel landing gear is fitted.

The power plant consists of a C.N.A. D.IV (Walter licence) four-cylinder in-line inverted air-cooled engine which drives a two-blade wooden airscrew. The fuel capacity is 60 litres (13.2 Imp gallons).

DIMENSIONS.—Span 9.85 m. (32 ft. 3½ in.). Length 6.37 m. (20 ft. 10¾ in.), Height 1.71 m. (5 ft. 7¼ in.), Wing area 14.35 sq. m. (154.4 sq. ft.).

WEIGHTS AND LOADINGS.—Weight empty 300 kg. (661 lbs.), Disposable load 215 kg. (474 lbs.), Normal weight loaded 515 kg. (1,135 lbs.), Maximum weight loaded 560 kg. (1,235 lbs.), Normal wing loading 39 kg./sq. m. (8 lbs./sq. ft.), Power loading 4.18 kg./CV (9.33 lbs./h.p.).

PERFORMANCE.—Maximum speed 170 km.h. (106 m.p.h.), Cruising speed (70% power) 145 km.h. (90 m.p.h.), Initial rate of climb 180 m./min. (590 ft./min.), Climb to 1,000 m. (3,280 ft.) 8 minutes. Climb to 2,000 m. (6,560 ft.) 18 minutes, Climb to 3,000 m. (9,840 ft.) 30 minutes, Ceiling 5,000 m. (16,405 ft.), Cruising range 580 km. (360 miles), Take-off run 130 m. (142 yds.).

BREDA.

SOCIETÁ ITALIANA ERNESTO BREDA.

HEAD OFFICE : VIA BORDONI 9, MILAN.

This enormous Milanese concern began building aircraft in 1917. From 1919 onwards, when the production of aircraft was at a standstill, the Breda Works carried on research work and built experimental machines. The construction of all-metal aircraft was begun in 1922.

In the years between the two wars it built both military and civil aircraft. Its best known products were the Breda 25 and 28 two-seat training biplanes, the Breda 65 single-engined Fighter-Reconnaissance monoplane and the Breda 88 twin-engined Bomber.

The Company's latest projects are the B.Z.308 four-engined passenger and/or freight monoplane, and the B.Z. 309 twin-engined high-wing monoplane for 11-15 passengers. Descriptions of these aircraft follow. A further projected version of the B.Z.308 with four 2,500 h.p. engines will have a loaded weight of 46,000 kg. (101,412 lbs.); and a payload of 7,000 kg. (15,432 lbs.). The maximum speed is estimated at 550 km.h. (342 m.p.h.) and the cruising speed at 450 km.h. (280 m.p.h.). Authorisation was obtained from the Allied Control Commission late in 1946 for the company to proceed with construction of six B.Z.308 airliners. These will probably be fitted with Bristol Hercules or Centaurus engines.

THE BREDA-ZAPPATA 308.

TYPE.—Four-engined Transport.

WINGS.—Cantilever low-wing monoplane. Structure in three main sections consisting of centre-section and two outer sections. All-metal two-spar structure, with stressed metal skin. Spars parallel in centre-section, front spar swept-back in outer sections. Constant dihedral from roots. Metal ailerons, with trim-tab in starboard aileron. Split trailing-edge flaps between ailerons and fuselage divided by inner engine nacelles. Aspect ratio 8.55. Wing area 206.6 sq. m. (2,224 sq. ft.).

FUSELAGE.—All-metal monocoque structure of oval cross-section with extruded I-section frames, extruded Z-section longitudinal stringers and stressed metal skin.

TAIL UNIT.—All-metal cantilever structure with twin elliptical fins and rudders mounted at ends of dihedral tailplane. Rudders and elevators balanced. Trim and balance-tabs in rudders.

LANDING GEAR.—Retractable tricycle type. Main wheels retract into inner engine nacelles leaving portions projecting. Track 8.1 m. (26 ft. 7 in.). Twin nose-wheels retract into fuselage.

POWER PLANT.—Four radial engines of unspecified make with approximate normal output (each) of 1,750 h.p. at 3,700 m. (12,140 ft.), and a maximum output of 2,000 h.p. for take-off. Three-blade airscrews. Fuel capacity 17,000 litres (3,740 Imp. gallons) in centre-section wing tanks. Oil capacity 660 litres (145 Imp. gallons). Engines, etc. can be inspected in flight from inside of wing centre-section. Outer engine centres 16.1 m. (52 ft. 9½ in.).

ACCOMMODATION.—Pilot and co-pilot side-by-side with dual controls in nose, with navigator's cabin, engineer's quarters and radio compartment behind. Main fuselage can be arranged in three different forms: as passenger aircraft with 24 seats in forward cabin 6.75 m. (22 ft. 2 in.) long and 31 passengers in rear cabin 8.8 m. (28 ft. 10½ in.) long; as combined passenger and cargo version with forward compartment forming hold for 3,000-4,000 kg. (6,614-8,818 lbs.) cargo, and 31 passengers in rear cabin; or as passenger and cargo version with 31 passengers in rear cabin and with smaller crew quarters permitting large forward hold 7.55 m. (24 ft. 9 in.) long. Cabins have mean width of 2.9 m. (9 ft. 6 in.) and mean height of 2.3 m. (7 ft. 6½ in.). Lavatory compartments, galley, bar and luggage compartments at rear. Additional cargo and mail holds under floor of forward fuselage accessible during flight, Passengers enter *via* retractable gangway under tail. In mixed freight and passenger versions access to forward freight hold by door 2 m. × 1.55 m. (6 ft. 6½ in. × 5 ft. 1 in.) on each side and one door 2.65 m. × 1.5 m. (8 ft. 8 in. × 4 ft. 10¾ in.) in roof. Side doors hinge upwards and serve as hoists. Pulley hoist along roof of hold.

DIMENSIONS.—Span 42.1 m. (138 ft. 2 in.), Length 33.52 m. (110 ft.) Height overall 7.15 m. (23 ft. 5¼ in.), Height over fuselage 6 m. (19 ft. 8 in.).

WEIGHTS AND LOADINGS (Designed).—Weight empty 23,000 kg. (50,706 lbs.), Normal disposable load 13,000 kg. (28,660 lbs.), Maximum disposable load 17,000 kg. (37,478 lbs.), Normal weight loaded 36,000 kg. (79,366 lbs.), Maximum weight loaded 40,000 kg. (88,184 lbs.), Normal wing loading 174 kg./sq. m. (35.6 lbs./sq. ft.), Maximum wing loading 193 kg./sq. m. (39.6 lbs./sq. ft.), Approximate normal power loading 4.5 kg./h.p. (9.9 lbs./h.p.), Approximate maximum wing loading 5 kg./h.p. (11 lbs./h.p.).

PERFORMANCE (Estimated).— Maximum speed 500 km.h. (311 m.p.h.), Cruising speed 420 km.h. (262 m.p.h.), Maximum range 5,000 km. (3,107 miles).

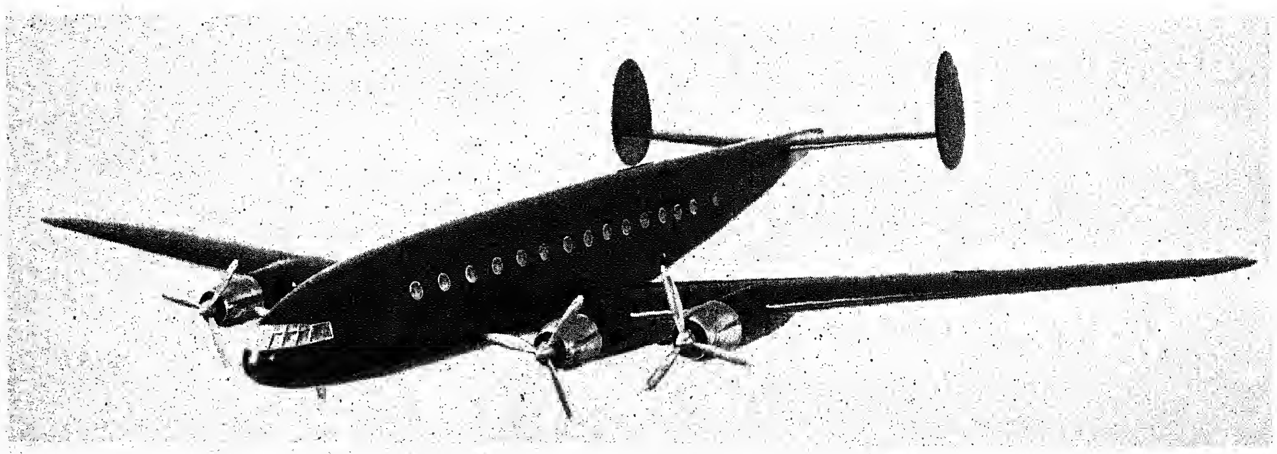
THE BREDA-ZAPPATA 309.

The B.Z.309 is a projected twin-engined cantilever high-wing monoplane designed for short-range air-line duties with a capacity for 11-15 passengers and a crew of two. It will be of light metal construction, with a tricycle undercarriage and a single fin and rudder. The power-plant will consist of two 900-1,000 h.p. engines of unspecified make.

DIMENSIONS.—Span 20 m. (65 ft. 7¼ in.), Length 14.75 m. (48 ft. 4¾ in.), Wing area 36.7 sq. m. (395 sq. ft.).

WEIGHTS AND LOADINGS (Designed).—Weight empty 3,650 kg. (8,047 lbs.), Passengers and baggage 1,100 kg. (2,425 lbs.), Crew 160 kg. (353 lbs.), Service load 140 kg. (309 lbs.), Fuel and oil 450 kg. (992 lbs.), Useful load 1,850 kg. (4,079 lbs.), Weight loaded 5,450 kg. (12,016 lbs.), Weight loaded with normal overload 5,950 kg. (13,117 lbs.), Weight loaded with maximum overload 6,450 kg. (14,220 lbs.), Wing loading (at 5,950 kg. = 13,117 lbs.) 161 kg./sq. m. (33.2 lbs./sq. ft.).

PERFORMANCE (Estimated).—Maximum speed 400 km.h. (249 m.p.h.), Cruising speed 330 km.h. (205 m.p.h.) at 2,500-3,000 m. (8,200 9,840 ft.), One-engine speed 250 km.h. (155 m.p.h.) at 2,500 m. (8,200 ft.), Ceiling over 7,000 m. (22,965 ft.).



A Model of the Breda-Zappata 308 Four-engined Transport.

CANT.

CANTIERI RIUNITI DELL'ADRIATICO.

HEAD OFFICE AND WORKS: MONFALCONE, TRIESTE.

The famous naval construction firm Cantieri Monfalcone entered the aircraft industry late in 1923. The aircraft branch, which was known as the Cantieri Riuniti dell'Adriatico, specialised in seagoing aircraft.

Of the many types of military and civil aircraft built by this Company, the Z.506B and Z.1007*bis* were used by the *Regia Aeronautica* during the war. Some of these aircraft survived to serve with that part of the Italian Air Force owing allegiance to the Italian Government which was recognised as a co-belligerent by the Allies on October 14, 1943.

The international dispute over Trieste affected the company in that the main shipyards at Monfalcone and aerodrome were in the Italian zone, whereas the offices and aircraft factory were in the disputed international zone. The aircraft factory was heavily damaged by air attack during the war but has now been repaired sufficiently to permit the company to undertake the manufacture of railway rolling-stock.

CAPRONI.

SOCIETA ITALIANA CAPRONI.

HEAD OFFICE AND WORKS: MILAN (TALIEDO).

The group of companies controlled by Count Gianni Caproni was the largest in Italy. It included the following aircraft manufacturing branches and subsidiaries:—Aeroplani Caproni S.A.; S.A. Office Reatine Lavorazioni Aeronautiche; S.A. Caproni-Vizzola; Compania Aeronáutica Bergamasca; S.A. Aeronautica Predappio; Officine Meccaniche "Reggiane"; Avio Industrie Stabiensi C. Coppola; Compania Nazionale Aeronautica; Aeroplani Caproni Trento and Aeronautica Sicula S.A.; as well as the famous Isotta-Fraschini aero-engine firm and its subsidiaries.

Of the large number of Caproni military aircraft, most of them designed for "Colonial" use, produced before the war, only one, the Ca 313, survived to be adopted for service as a light liaison aeroplane by the German Air Force. A number of aircraft of this type was also acquired by the Swedish Government at a time when Sweden was cut off from the outside world.

In 1946 the main Caproni S.A. works in Milan were fulfilling a contract to overhaul 50 Ca 146 light trainers originally built by the S.A. Aeronautica Predappio, as well as overhauling British and American motor vehicles. Its first order for aircraft received during 1946 was for ten Ca 313 twin-engined trainers for the post-war Italian Air Force.

The Cia. Aeronautica Bergamasca was building Lancia motor lorries; Caproni-Trento was overhauling fighter aircraft; and the Officine Meccaniche "Reggiane" was engaged in the manufacture of railway coaches.

CMA.

CONSTRUZIONI MECCANICHE AERONAUTICHE S.p.A.

HEAD OFFICE AND WORKS: MARINA DI PISA.

President. Ragg. Roberto Massiglia.

Production Manager: Ing. Sergio Rizzi.

The Construzioni Meccaniche Aeronautiche S.A. was formed in 1921 to undertake the manufacture of all-metal flying-boats under Dornier licence. In 1932, the company became associated with the Fiat concern. The last aircraft produced by the company was the Fiat A.S.14, an attack development of the Fiat R.S.14 reconnaissance seaplane. The Fiat CA.15 high speed monoplane and the Fiat J.S.54 six-engined civil flying-boat were under development when, in September, 1943, the company suspended all operations.

The works at Marina di Pisa were heavily damaged in 1944 but they are now being repaired with a view to the resumption of aircraft manufacture in the near future.

FIAT.

AERONAUTICA D'ITALIA.

HEAD OFFICE AND WORKS: CORSO FRANCIA 366, TURIN.

Chairman: Ing. Gaudenzio Bono.

General Manager and Chief Designer: Ing. Giuseppe Gabrielli.

Manager: Ing. Bartolomeo Galli.

This concern was formed in January, 1916, under the name Societa Anonima per Construzione Ing. O. Pomilio & Co. On April 24, 1920, it changed its name to Aeronautica Ansaldo S.A. and in the Summer of 1925 began the construction of Fiat aircraft. On March 30, 1926, it was incorporated in the Fiat Group under its present name.

Most of the various products of the Fiat concern, including the C.R.42 fighter, the B.R.20 bomber and the G.50 fighters, have been described and illustrated in past issues of "All the World's Aircraft." Only one Fiat type, the R.S.14 torpedo-bomber-reconnaissance seaplane, survived to serve with the co-belligerent Italian Air Force in small numbers. Particulars of this design were given in the last issue of this Annual.

In 1946, Fiat, the most active of all Italian aircraft manufacturers, was engaged in the production of twenty G.12 transports and was seeking permission from the Allied control authorities to build a further twelve to fourteen, some of which the company hopes to export to South America. The prototype of the G.212 is also being built.

In addition it is building a small series of the G.46; twelve G.55 fighter trainers, six as single-seaters and six as two-seaters; and two G.40 single-seat fighter developments of the G.55. Types projected are the G.22, G.24, G.26 and G.218 twin-engined airliners and the G.41, G.42, G.44 and G. 46 *bis* touring aircraft.

Fiat is also converting a number of Douglas C-47s for the Linee Aeree Italiane, which is partly owned by TWA.

THE FIAT G.12 CA.

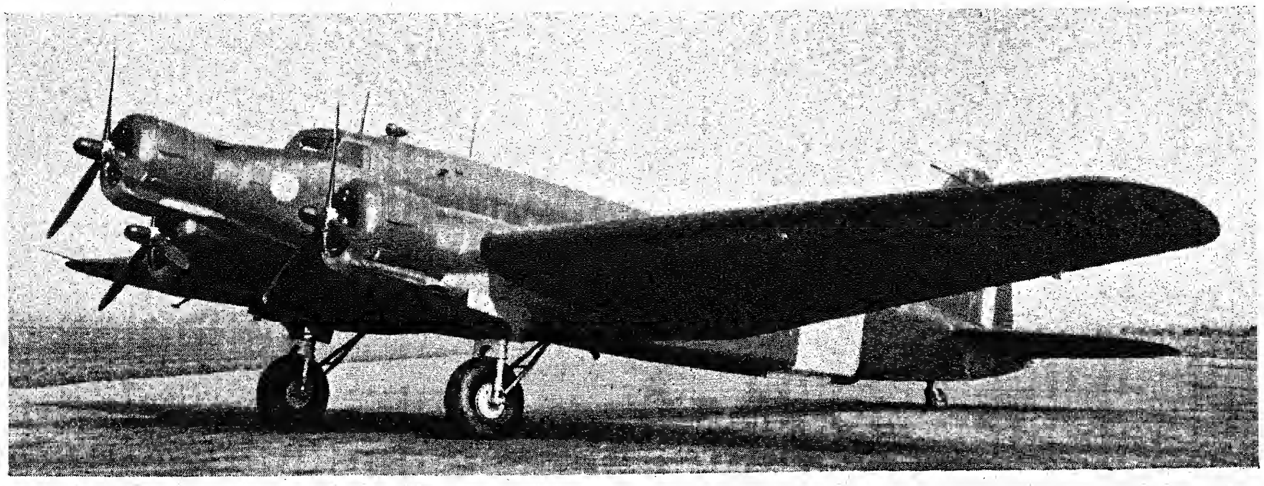
TYPE.—Three-engined eighteen-passenger Airliner.

WINGS.—Cantilever low-wing monoplane. All-metal structure in three sections consisting of centre-section carrying port and starboard engines and two tapering outer sections. Centre-section is steel-tube lattice structure. Outer sections built entirely of duralumin and have three spars and metal sheet covering except for fabric-covered trailing-edge section. Fabric-covered metal ailerons are statically and aerodynamically-balanced and have controllable balance-tab in each. Wing area 113 sq. m. (1,215 sq. ft.).

FUSELAGE.—Box-section structure entirely of duralumin. Maximum width 1.66 m. (5 ft. 5¼ in.).

TAIL UNIT.—Cantilever monoplane type with metal-covered fin and tailplane and fabric-covered rudder and elevators. Rudder and elevators statically and aerodynamically-balanced and have controllable trim and balance tabs.

LANDING GEAR.—Retractable two-wheel type. Main wheels carried between twin shock-absorber legs retract forward into engine nacelles, leaving portion of each wheel projecting for emergency landing in retracted position. Medium-pressure tyres with pneumatic brakes. Tail-wheel carried in steel fork on oleo-



The Fiat G.12 CA Airliner (three 840 h.p. Alfa Romeo 128 RC engines).

FIAT—*continued.*

pneumatic shock-absorber struts retracts into fuselage. Track 6.25 m. (20 ft. 6 in.).

Power Plant.—Three Alfa Romeo 128 RC 18 nine-cylinder radial air-cooled engines each developing 840 h.p. at 1,800 m. (5,900 ft.) enclosed in Magni cowlings with controllable gills. Fiat three-blade constant-speed variable-pitch metal airscrews. Ten fuel tanks in centre-section and outer wings with total capacity of 4,490 litres (988 Imperial gallons). Oil tanks of 120 litres (26.4 Imp. gallons) capacity behind engines.

Accommodation.—Pilot's enclosed cockpit with two seats side-by-side with dual controls. Radio compartment immediately behind with capacity of 4.2 cub. m. (148 cub. ft.). Main passenger cabin 7.012 long × 1.9 high × 1.54 m. wide (22 ft. 11 in. × 6 ft. 3 in. × 4 ft. 11 in.) has capacity of 19.6 cub. m. (692 cub. ft.). Eighteen passenger seats in two rows of nine with central gangway. Entry door on port aft of cabin. Individual oxygen masks for passengers. Toilet compartment aft opposite entry door has capacity of 1.2 cub. m. (42 cub. ft.). Main luggage compartment aft is accessible through toilet compartment and through door on starboard side of fuselage. Two other compartments of 0.4 cub. m. (14 cub. ft.) capacity forward. Further compartment under fuselage with capacity of 2 cub. m. (70 cub. ft.) divided into three compartments, each of which is accessible by door on port side of fuselage.

Dimensions.—Span 28.72 m. (94 ft. 2½ in.), Length 20.651 m. (67 ft. 9½ in.), Height 4.9 m. (16 ft. 0 in.).

Weights and Loadings.—Weight empty 9,400 kg. (20,725 lbs.) payload 6,100 kg. (13,450 lbs.), Weight loaded 15,000 kg. (33,070 lbs.), Wing loading 137 kg./sq. m. (28.1 lbs./sq. ft.), Power loading 5.55 kg./C.V. (12.15 lbs./h.p.), Span loading 24.7 C.V./sq. m. (2.25 h.p./sq. ft.).

Performance.—Maximum speed 380 km.h. (237 m.p.h.) at 2,500 m. (8,200 ft.), Cruising speed 300 km.h. (187.5 m.p.h.), absolute ceiling 6,800 m. (22,300 ft.), One-engine ceiling 3,700 m. (12,120 ft.). Climb to 4,000 m. (13,120 ft.) 14.5 minutes, Range at cruising speed 2,900 km. (1,815 miles), Take-off run 420 m. (460 yds), Landing run 250 m. (273 yds.), Consumption 1.13 kg./km. (4 lbs./mile).

THE FIAT G.12L.

The G.12L is a later version of the G.12CA just described. It is generally similar but can accommodate up to 22 passengers and is powered by three Fiat A74 RC.42 nine-cylinder radial air-cooled engines each developing 820 h.p. for take-off and with a normal output of 770 h.p. at 4,200 m. (13,800 ft.).

Dimensions.—Span 28.72 m. (94 ft. 2½ in.), Length 22.425 m. (73 ft. 7 in.), Height (tail up) 7.80 m. (25 ft. 7 in.).

Weights and Loadings (Designed).—Weight empty 9,850 kg. (21,715 lbs.), Disposable load 5,650 kg. (12,456 lbs.), Weight loaded 15,500 kg. (34,171 lbs.), Wing loading 137 kg./sq. m. (27.6 lbs./sq. ft.), Power loading 6.3 kg./CV (14.08 lbs./h.p.).

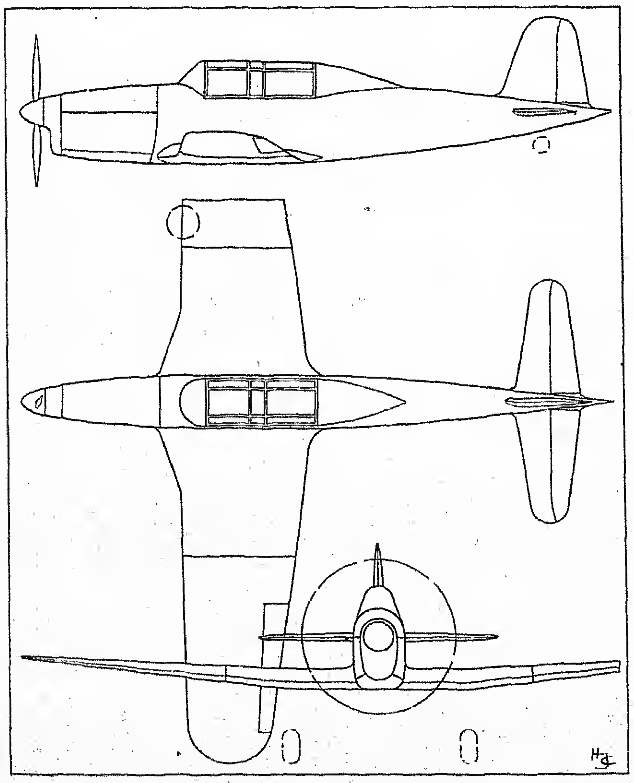
Performance (Estimated).—Maximum speed 390 km.h. (242 m.p.h.) at 4,800 m. (13,385 ft.), Cruising speed (80% power) 312 km.h. (194 m.p.h.). Climb to 4,000 m. (13,125 ft.) 14 minutes, Ceiling 8,500 m. (27,890 ft.), One-engine ceiling 4,000 m. (13,125 ft.), Cruising range with 18 passengers 2,450 (1,522 miles), Maximum range with 4,490 litres (988 Imp. gallons) 3,100 km. (1,926 miles).

THE FIAT G.212.

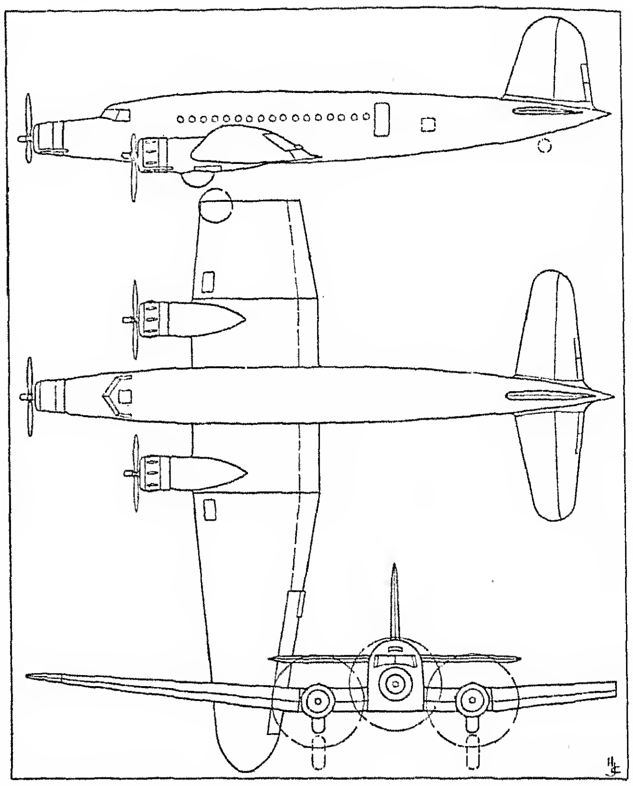
Type.—Three-engined thirty-passenger Airliner.

Wings.—Structure as G.12. Wing area 116.6 sq. m. (1,252 sq. ft.). Aspect ratio 7.35.

Fuselage, Tail Unit and Landing Gear.—Structure as G.12.



The Fiat G.46 Trainer.



The Fiat G.212 Airliner.

Power Plant.—Three Alfa Romeo 128 RC.18 nine-cylinder radial air-cooled engines each developing 860 h.p. at 1,800 m. (5,900 ft.) or three Pratt & Whitney R-1830 Twin-Wasp fourteen-cylinder two-row radial air-cooled engines each rated at 1,065 h.p. at 1,890 m. (3,840 ft.). Engines enclosed in Magni cowlings with controllable gills and driving S.I.A.I. Idrovaria 55 three-blade constant-speed metal airscrews, 3.60 m. (11 ft. 10 in.) diameter. Pneumatic engine starters.

Accommodation.—Pilot's enclosed cockpit with seats for two side-by-side with dual controls. Radio compartment immediately behind with capacity of 5 cub. m. (176 cub. ft.). Main passenger cabin 7.9 long × 1.90 high × 2.10 m. wide (25 ft. 10¾ in. × 6 ft. 3 in. × 6 ft. 10¾ in.) has capacity of 28.8 cub. m. (1,017 cub. ft.). Thirty passenger seats arranged in three rows of ten, two on starboard and one on port with central gangway. 40 passengers can also be accommodated for a shorter range. Entry door on port at rear of cabin. Individual oxygen masks for passengers. Aft of passenger cabin is toilet compartment (on starboard) and bar. Main luggage compartment at rear with capacity of 5.75 cub. m. (203 cub. ft.) is accessible through toilet compartment and through door on starboard side of fuselage. Further luggage compartment under floor of passenger cabin, and two compartments with capacity (each) of 0.43 cub. m. (15 cub. ft.) in fuselage ahead of wing. Total luggage capacity of 7.8 cub. m. (275 cub. ft.).

Dimensions.—Span 29.344 m. (96 ft. 4 in.), Length 23.052 m. (75 ft. 8¼ in.), Height 5.84 m. (10 ft. 6 in.).

Weights and Loadings (Alfa Romeo engines).—Weight empty 10,000 kg. (22,046 lbs.), Payload 6,000 kg. (13,228 lbs.), Weight loaded 16,000 kg. (35,274 lbs.), Wing loading 137.5 kg./sq. m. (28.3 lbs./sq. ft.), Power loading 5.75 kg./C.V. (12.15 lbs./h.p.), Span loading 24 C.V./sq. m. (2.19 h.p./sq. ft.).

Weights and Loadings (Twin-Wasp engines).—Weight empty 10,400 kg. (22,928 lbs.), Disposable load 7,000 kg. (15,432 lbs.), Weight loaded 17,400 kg. (38,360 lbs.), Wing loading 149 kg./sq. m. (30.07 lbs./sq. ft.), Power loading 4.78 kg./C.V. (10.67 lbs./h.p.).

Performance (Alfa Romeo engines).—Maximum speed 360 km.h. (225 m.p.h.) at 2,500 m. (8,200 ft.), Cruising speed 290 km.h. (181 m.p.h.) at 2,500 m. (8,200 ft.), Climb to 4,000 m. (13,100 ft.) 16 minutes, Absolute ceiling 6,800 m. (22,300 ft.), One-engine ceiling 3,700 m. (12,120 ft.), Range at cruising speed 1,650 km. (1,030 miles), Take-off run 430 m. (470 yds.), Landing run 300 m. (328 yds.), Fuel consumption at cruising speed 1.3 kg./km. (4.6 lbs./mile).

Performance (Twin-Wasp engines).—Maximum speed 375 km.h. (233 m.p.h.), at 2,500 m. (8,200 ft.), Ceiling 6,850 m. (22,475 ft.), One-engine ceiling 4,200 m. (13,780 ft.), Normal range 2,500 km. (1,553 miles), Maximum range 3,000 km. (1,864 miles).

THE FIAT G.46.

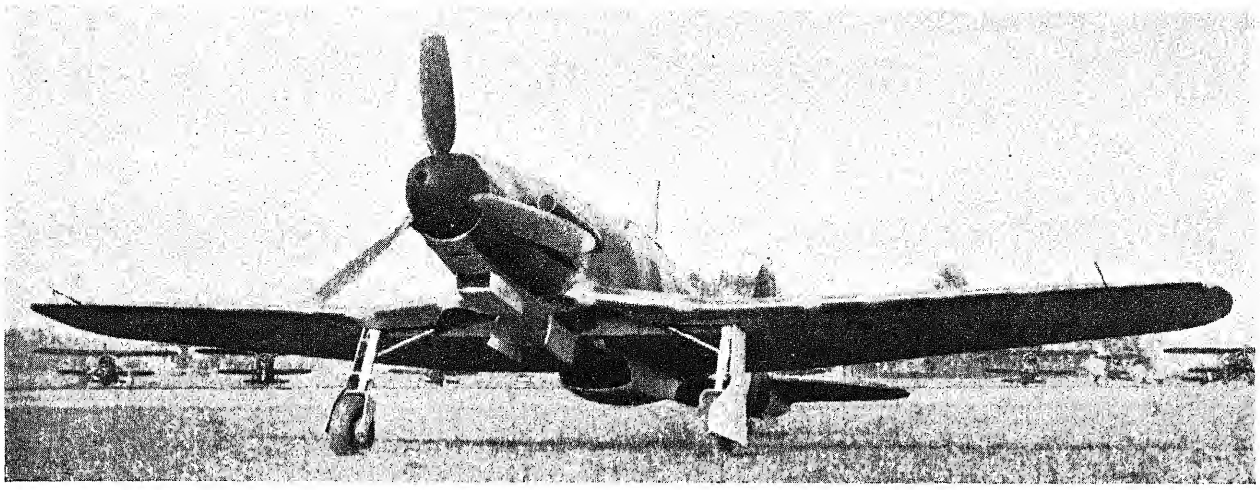
Type.—Two-seat Trainer.

Wings.—Cantilever low-wing monoplane, consisting of long-span centre-section bolted to fuselage and two outer sections with semi-circular tips. All-metal structure with two extruded L-section spars with single web. Flush-riveted metal covering. Fabric-covered metal ailerons and hydraulically-operated split trailing-edge flaps. Wing area 16 sq. m. (173 sq. ft.).

Fuselage.—All-metal monocoque structure with vertical open-section frames, longitudinal open-section stringers and metal covering.

Tail Unit.—All-metal cantilever monoplane type. Tailplane and fin covered with metal; elevators and rudder with fabric. Trim-tabs in elevators and rudder tab adjustable on ground.

FIAT—*continued.*



The Fiat G.55 Single-seat Fighter Trainer (1,250 h.p. Fiat-built Daimler-Benz DB-605 engine).

LANDING GEAR.—Retractable two-wheel type. Main wheels retract inward under fuselage. Oleo-pneumatic shock-absorber struts. Steerable tail-wheel retracts into fuselage. Hydraulic operation

POWER PLANT.—One 195 h.p. Alfa Romeo 115-1 *bis* six-cylinder in-line inverted air-cooled engine driving a two-blade variable-pitch metal airscrew. Two fuel tanks of 160 litres (35.2 Imperial gallons) capacity in wings.

ACCOMMODATION.—Enclosed cabin seating two in tandem, with dual controls. Hood hinges for access and can be jettisoned. Forward arch reinforced and attached to fuselage as separate structure.

DIMENSIONS.—Span 10.4 m. (34 ft. 1¼ in.), Length 8.54 m. (28 ft. 0 in.), Height 2.55 m. (8 ft. 4 in.).

WEIGHTS AND LOADINGS.—Weight empty 880 kg. (1,935 lbs.), Disposable load 320 kg. (704 lbs.), Weight loaded 1,200 kg. (2,639 lbs.), Wing loading 75 kg./sq. m. (15.3 lbs./sq. ft.), Power loading at take-off 5.85 kg./h.p. (12.39 lbs./h.p.), Span loading 12.8 h.p./sq. m. (1.16 h.p./sq. ft.).

PERFORMANCE.—Maximum speed 300 km.h. (187.5 m.p.h.) at sea level, Cruising speed 240 km.h. (150 m.p.h.) at sea level, Climb to 5,700 m. (18,650 ft.) 37 minutes, Service ceiling 5,700 m. (18,650 ft), Absolute ceiling 6,500 m. (21,150 ft.), Range at cruising speed 950 km. (594 miles), Take-off run 110 m. (122 yds.), Landing run 87 m. (87.5 yds.).

THE FIAT G.26.

The G.26 is a projected twin-engined commercial monoplane to carry ten passengers, baggage and mail. It is a cantilever low-wing monoplane of all-metal construction, with a single fin and rudder and a retractable two-wheel landing gear. It is to be powered by Alvis Leonides nine-cylinder radial air-cooled engines each rated at 505 h.p. for take-off and with a maximum output of 525 h.p. at 1,495 m. (4,900 ft.).

DIMENSIONS.—Span 17.90 m. (58 ft. 8 in.), Length 13.37 m. (43 ft. 10 in.).

WEIGHTS AND LOADINGS (Designed).—Weight empty 2,840 kg. (6,261 lbs.), Disposable load 1,835 kg. (4,045 lbs.), Weight loaded 4,675 kg. (10,306 lbs.), Wing loading 120 kg./sq. m. (24.56 lbs./sq. ft.), Power loading 4.63 kg./CV (10.34 lbs./h.p.).

PERFORMANCE (Estimated).—Maximum speed 395 km.h. (245 m.p.h.) at 1,800 m. (3,540 ft.), Cruising speed (80% power) 315 km.h. (196 m.p.h.), Climb to 4,000 m. (13,125 ft.) 11 minutes 50 seconds, Ceiling 7,900 m. (25,910 ft.), One-engine ceiling 4,600 m. (15,090 ft.), Cruising range 1,300 km. (808 miles), Maximum range with 1,000 litres (220 Imp. gallons) fuel 2,000 km. (1,243 miles).

THE FIAT G.218.

The G.218 is a projected twin-engined transport aircraft to carry 30-36 passengers, baggage and mail. It is a cantilever low-wing monoplane of all-metal construction, with a constant-chord centre-section and two tapered outer wings. It has a single fin tail-unit and the landing gear consists of two main units which retract forward into the engine nacelles leaving a small portion of each wheel projecting to permit a safe emergency wheel-up landing to be made.

The power plant will consist of two Bristol Hercules 730 fourteen-cylinder two-row radial sleeve-valve air-cooled engines each rated at 1,950 h.p. for take-off and with a normal output of 1,605 h.p. at 1,450 m. (4,750 ft.). Other engines of similar power and weight may be installed. Fuel tanks with a total capacity of 4,490 litres (988 Imp. gallons) are installed in the centre-section and outer wings on each side of the fuselage.

DIMENSIONS.—Span 29.344 m. (96 ft. 3 in.), Length 23.90 m. (78 ft. 4¾ in.), Height (tail down over cabin) 6.20 m. (20 ft. 4 in.), Height (tail up, on ground) 8.124 m. (26 ft. 7½ in.).

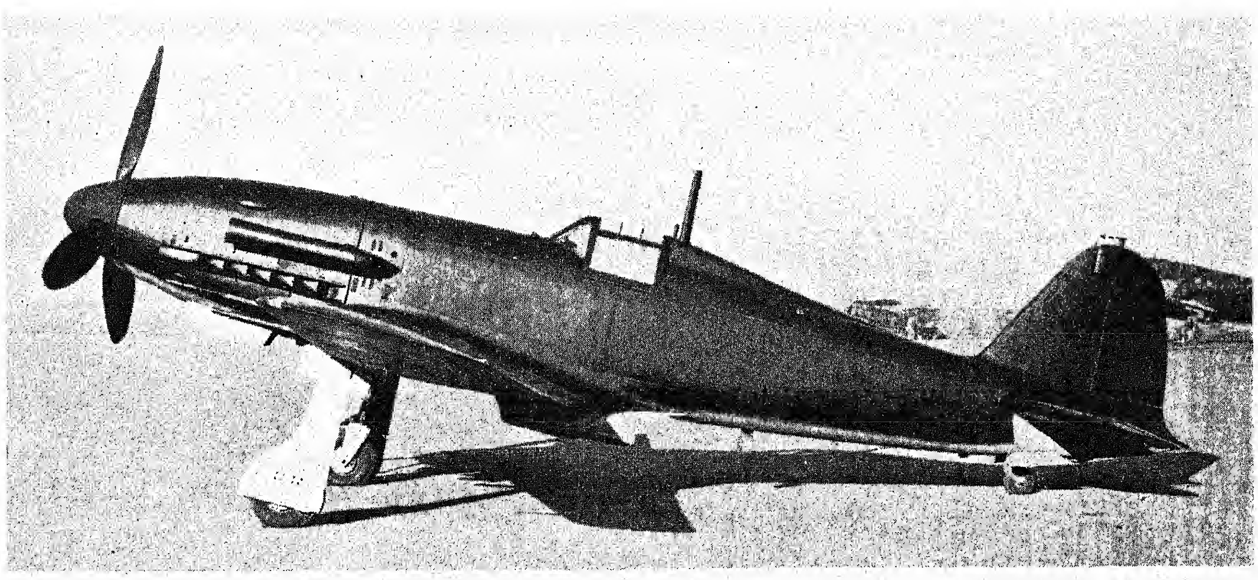
WEIGHTS AND LOADINGS (Designed).—Weight empty 10,600 kg. (23,370 lbs.), Disposable load 6,800 kg. (14,990 lbs.), Weight loaded 17,400 kg. (38,360 lbs.), Wing loading 149 kg./sq. m. (30.07 lbs./sq. ft.), Power loading 4.45 kg./CV (9.94 lbs./h.p.).

PERFORMANCE (Estimated).—Maximum speed 410 km.h. (255 m.p.h.) at 1,800 m. (3,540 ft.), Cruising speed (80% power) 330 km.h. (205 m.p.h.), Climb to 5,000 m. (16,405 ft.) 18 minutes, Ceiling 7,600 m. (24,935 ft.), One-engine ceiling 4,700 m. (13,350 ft.), Cruising range 1,500 km. (932 miles), Maximum range 3,000 km. (1,864 miles).

THE FIAT G.55.

TYPE.—Single or two-seat Fighter Trainer.

WINGS.—Cantilever low-wing monoplane. All-metal structure consisting of two main sections bolted together on fuselage centre-line and detachable tips bolted on. Two main spars, longitudinal stringers and stressed skin covering. Metal statically and aerodynamically-balanced ailerons with fabric covering. Wing area 21·11 sq. m. (228 sq. ft.).



The Fiat G.56 Single-seat Fighter (1,510 h.p. Fiat-built Daimler-Benz DB-603A engine).

FIAT—continued.

Fuselage.—All-metal structure of elliptical cross-section, with vertical frames, longitudinal stringers and metal covering riveted on.

Tail Unit.—Cantilever monoplane type. Metal structure with stressed metal skin over tailplane and fin, and fabric covering to balanced elevators and rudder. Rudder trim-tab.

Landing Gear.—Retractable two-wheel type. Main wheels, each carried in fork on oleo-pneumatic shock-absorber leg, retract inward into wings forward of front spar and are enclosed by fairing plates attached to legs and by hinged doors under fuselage. Tail wheel retracts backwards into fuselage and is enclosed by twin doors. Hydraulic operation. Elektron main wheels with double brakes.

Power Plant.—One Fiat-built Daimler-Benz DB-605 twelve-cylinder inverted-vee liquid-cooled engine rated at 1,250 h.p. at 5,800 m. (17,700 ft.) and driving Piaggio 2001 three-blade variable-pitch airscrew. Two fuel tanks in fuselage and two in each wing. Total capacity 560 litres (123.2 Imperial gallons).

Accommodation.—Pilot's enclosed cockpit, with fixed forward portion and sliding cover which can be jettisoned. Fixed rear portion of steel sheet with crash-arch.

Armament.—Three 20 m/m. cannon, one firing through airscrew shaft and one in each wing firing outside airscrew disc, with total of 650 rounds, and two synchronised 12.7 m/m. (0.5 in.) machine-guns firing through channels in fuselage with total of 600 rounds. Provision for 160 kg. (350 lbs.) bomb under each wing, or bomb or torpedo under fuselage.

Dimensions.—Span 11.85 m. (38 ft. 10¾ in.), Length 9.37 m. (30 ft. 9 in.), Height 3.13 m. (10 ft. 3 in.).

Weights and Loadings.—Weight empty 2,700 kg. (5,940 lbs.), Military load 1,018 kg. (2,235 lbs.), Weight loaded 3,718 kg. (8,152 lbs.), Wing loading 176.5 kg./sq. m. (35.98 lbs./sq. ft.), Power loading 2.98 kh./h.p. (6.32 lbs./h.p.), Span loading 59.6 h.p./sq. m. (5.64 h.p./sq. ft.).

Performance.—Maximum speed 620 km.h. (388 m.p.h.) at 7,000 m. (22,950 ft.), Stalling speed 163 km.h. (102 m.p.h.), Climb to 7,000 m. (22,950 ft.) 8.5 minutes, Service ceiling 12,700 m. (41,620 ft.), Absolute ceiling 13,000 m. (42,550 ft.), Range 1,200 km. (750 miles), Duration 2.5 hours at 496 km.h. (291 m.p.h.), Take-off run 300 m. (328 yds.), Landing run 450 m. (492 yds.).

THE FIAT G.56.

The G.56 is structurally identical to the G.55 but is powered by the DB-603A twelve-cylinder inverted-vee liquid-cooled engine rated at 1,510 h.p. at 5,700 m. (18,700 ft.) and driving a V.D.M. three-blade variable-pitch airscrew. The total fuel capacity (two tanks in fuselage and two in each wing) is 596 litres (131 Imperial gallons). Armament consists of three 20 m/m. cannon, one firing through the airscrew shaft and one in each wing outside the airscrew disc, with a total of 800 rounds.

Dimensions.—As G.55 except length, 9.46 m. (31 ft. 0½ in.).

Weights and Loadings.—Weight empty 2,900 kg. (6,358 lbs.), Military load 954 kg. (2,099 lbs.), Weight loaded 3,854 kg. (8,457 lbs.), Wing loading 183 kg./sq. m. (37.12 lbs./sq. ft.), Power loading 2.55 kg./C.V. (5.399 lbs./h.p.), Span loading 72 C.V./sq.m. (6.56 h.p./sq. ft.).

Performance.—Maximum speed 685 km.h. (428 m.p.h.) at 7,000 m. (22,950 ft.), Stalling speed 166 km.h. (94 m.p.h.), Rate of climb up to 1,000 m. (3.280 ft.) 1.260 m./min. (4,135 ft./min.), Climb to 7,000 m. (22.950 ft.) 7 minutes 5 seconds, Service ceiling 13,000 m. (42,650 ft.), Absolute ceiling 13,600 m. (44,620 ft.), Range 1,280 km. (800 miles), Duration 2.5 hours at 538 km.h. (312 m.p.h.), Take-off run 300 m. (328 yds).

LOMBARDA.

AERONAUTICA LOMBARDA S.A.

Head Office: Milan.

This Company is the successor to the Aeronautica Vittorio Bonomi, which was established in 1931. During the war years the Aeronautica Lombarda designed the A.L. 12P cargo and troop-carrying glider, a cantilever high-wing monoplane with a single fin and rudder and a fixed spatted landing gear. This aircraft formed the prototype of the A.L.T. single-engined transport monoplane, a brief description of which follows.

The present activities of the Company are not known.

THE LOMBARDA A.L.T.

The A.L.T. is a cantilever monoplane suitable for freight and passenger carrying and was developed from the A.L. 12P high-wing cargo glider. It is of all-wood construction and is powered by a single engine of 450 h.p. The wing is a single-spar structure with plywood covering, and carries variable-camber trailing-edge flaps. The fuselage is a wooden monocoque, and the tail-unit is constructed similarly to the wing. A fixed two-wheel landing gear comprising oleo-pneumatic shock-absorbers is fitted.

The main cabin is 4.60 m. (15 ft. 1 in.) long, and is accessible by side doors and by hatches in the floor. Dual controls are provided.

Dimensions.—Span 21.30 m. (69 ft. 10¾ in.), Length 14 m. (45 ft. 11 in.), Height 3.25 m. (10 ft. 8¼ in.), Wing area 50.7 sq. m. (545.7 sq. ft.), Aspect ratio 9.1.

Weights and Loadings.—Weight loaded 4,000 kg. (8,818 lbs.), Wing loading 79 kg./sq. m. (16.18 lbs./sq. ft.), Power loading 8.9 kg./CV (19.9 lbs./h.p.).

Performance.—No data available.

MACCHI.

AERONAUTICA MACCHI S.A.

Head Office: Galleria Matteotti 37B, Milan.

Offices and Works: Varese.

President: Avv. Prof. Vittorio Franchini.

Director-General: Dott. Ing. Paolo Foresio.

The Macchi company was founded in 1912 in Varese and its first aeroplane was built in 1913.

During the war 1914-18 the company built 1,375 aircraft and between the wars it established for itself a world-wide reputation as the designers and builders of a series of racing seaplanes. The Macchi 7 flying-boat won the 1921 Schneider Trophy contest, the Macchi 39 the 1926 contest and the Macchi 52 *bis* was second in the 1929 contest.

In March, 1928, the Macchi 52 *bis* put up a Speed Record for seaplanes of 509.4 km.h. (318.4 m.p.h.). In April, 1933, the Macchi-Castoldi 72 established a World's Speed Record with a speed of 682.1 km.h. (423.57 m.p.h.) and in October of the following year the same aircraft with a higher-powered engine raised the World's Record to 709.2 km.h. (440.67 m.p.h.). The absolute record was held for five years until beaten by Germany but the achievement still stands to the credit of Italy as a seaplane record.

Macchi also built a number of flying-boats, of which the twin-engined M.C.94 and three-engined M.C.100 were developed for the Italian civil airlines.

In 1938 the company produced the M.C.200 all-metal single-seat fighter monoplane which, with its Daimler-Benz-engined derivitives, was said to be one of the best fighters used by the Italian Air Force in the last war. The M.C.200 and M.C.202 were built in series by both the Breda and S.A.I. companies and the M.C.205 by the Fiat concern.

Since the end of the war the Macchi company has undertaken the development of two new light civil aircraft, brief details of which follow. The company is also engaged in the manufacture of motor lorries and furniture.

THE MACCHI M.B. 308.

The M.B. 308 is a light cantilever high-wing monoplane fitted with a fixed tricycle landing-gear and powered by a 60 h.p. N.1 C.N.A. D.4 four-cylinder horizontally-opposed air-cooled engine. The enclosed cabin seats two side-by-side.

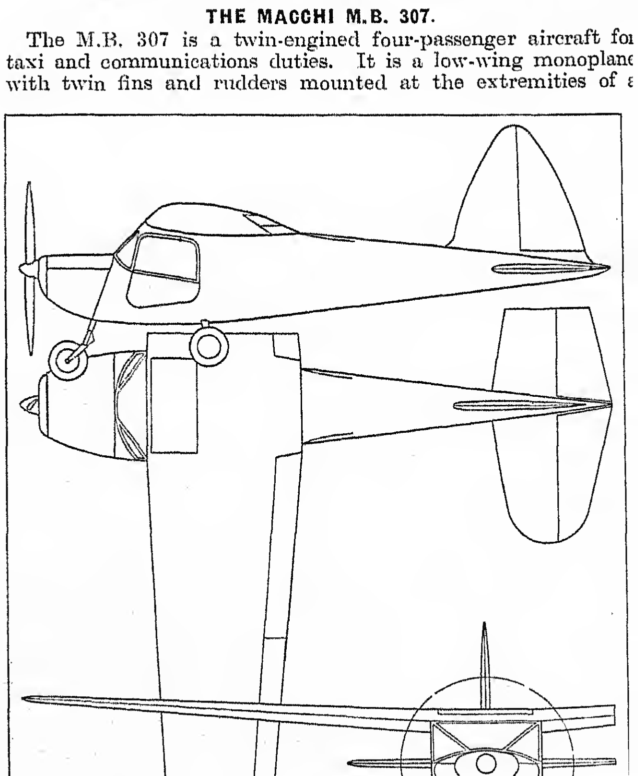
Dimensions.—Span 10 m. (32 ft. 9½ in.), Length 6.452 m. (21 ft. 2 in.), Height 2.175 m. (7 ft. 1½ in.).

Weights and Loadings.—Weight empty 320 kg. (705 lbs.), Useful load 230 kg. (507 lbs.), Weight loaded 550 kg. (1,212 lbs.), Wing loading 39.3 kg./sq. m. (8.59 lbs./sq. ft.), Power loading 9.16 kg./h.p. (20.19 lbs./h.p.).

Performance.—Maximum speed 185 km.h. (115 m.p.h.), Cruising speed 160 km.h. (99 m.p.h.), Climb to 1,000 m. (3,280 ft.) 6½ minutes, Practical ceiling 4,500 m. (14,765 ft.), Range 900 km. (559 miles).

THE MACCHI M.B. 307.

The M.B. 307 is a twin-engined four-passenger aircraft fo[r] taxi and communications duties. It is a low-wing monoplan[e] with twin fins and rudders mounted at the extremities of [a]



The Macchi M.B. 308 Cabin Monoplane.

MACCHI—continued.

dihedral tailplane, and has a retractable two-wheel undercarriage. The power-plant consists of two 135 h.p. Alfa Romeo 111 or Cirrus-Major III four-cylinder in-line inverted air-cooled engines.

DIMENSIONS.—Span 12.5 m. (41 ft. 0 in.), Length 8.4 m. (27 ft. 6¾ in.), Height 2.5 m. (8 ft. 2½ in.).

WEIGHTS AND LOADINGS.—Weight empty 1,300 kg. (2,866 lbs.), Useful load 650 kg. (1,433 lbs.), Weight loaded 1,950 kg. (4,299 lbs.), Wing loading 100 kg./sq. m. (20.05 lbs./sq. ft.), Power loading 7.2 kg./h.p. (15.87 lbs./h.p.).

PERFORMANCE.—Maximum speed 317 km.h. (197 m.p.h.) at 2,500 m. (8,200 ft.), Cruising speed (70% power) 255 km.h. (158 m.p.h.) at 2,500 m. (8,200 ft.), Climb to 1,000 m. (3,280 ft.) 3 minutes, Practical ceiling 6,400 m. (21,000 ft.), Range 1,600 km. (944 miles).

MERIDIONALI.

S.A. INDUSTRIE MECCANICHE E AERONAUTICHE MERIDIONALI (BREDA).

HEAD OFFICE AND WORKS: NAPLES.

This concern was, up to 1936, known as the Societa Anonima Industrie Aeronautiche Romeo, which was formed in 1934 to take over the aeronautical activities of the Officine Ferroviarie Meridionali.

The Officine Ferroviarie Meridionali entered the Italian Aircraft Industry in 1923 and two years later this concern acquired the rights to build Fokker aeroplanes under licence.

In 1936, the Societa Anonima Industrie Aeronautiche Romeo absorbed the industrial activities of the Officine Ferroviarie Meridionali and changed its name to Industrie Meccaniche e Aeronautiche Meridionali.

No information has been made available concerning its present activities.

PIAGGIO.

SOCIETA ANONIMA PIAGGIO & C.

HEAD OFFICE: GENOA.

The famous firm of engineers and shipbuilders entered the aircraft industry in 1916. Some years later the firm began aero-engine manufacture at their Pontedera factory while aircraft construction was concentrated at the Sestri and Finale works.

At the Finale-Ligure works the firm built aeroplanes, sea planes and flying-boats, both in wood and metal.

In 1946 it was engaged in helicopter research, in the overhaul of Cant Z.506 seaplanes and in the conversion of Douglas C-47 transports into civil airliners. It was also constructing railway coaches.

THE PIAGGIO P.D.3 HELICOPTER.

The Piaggio P.D.3 is an experimental helicopter with a three-blade main rotor and a rear vertical rotor for anti-torque control. It is a steel-tube structure with fabric covering, and the rotor blades each have a single steel-tube spar, wooden ribs and fabric covering. The crew compartment is in the fuselage between the engine and the rotor shaft.

The power plant consists of a 200 h.p. Alfa Romeo 115 six-cylinder in-line air-cooled engine mounted in the nose and driving the rotor gear unit installed in the centre fuselage *via* a horizontal extension shaft. The gear unit consists of two bevel gears and an epicyclic reduction gear with a vertical shaft to the rotor. The auxiliary tail rotor is driven by a hollow shaft geared to the main bevel gear. A clutch between the engine and the transmission shaft permits free rotation of the rotor in the event of engine failure.

Longitudinal control is achieved by altering the angle of incidence of the blades, while rotation about the vertical axis is by modification of the angle of the blades of the rear auxiliary rotor. The axis of the main rotor is slightly inclined to compensate for the lateral thrust of the tail rotor.

DIMENSIONS.—Rotor diameter 13 m. (42 ft. 8¼ in.), Rotor disc area 132.5 sq. m. (1,426 sq. ft.).

WEIGHTS AND LOADINGS.—Weight empty 810 kg. (1,786 lbs.), Normal Disposable load 190 kg. (419 lbs.), Maximum disposable load 390 kg. (860 lbs.), Normal weight loaded 1,000 kg. (2,205 lbs.), Maximum weight loaded 1,200 kg. (2,646 lbs.), Rotor disc loading (normal) 7.55 kg./sq. m. (1.54 lbs./sq. ft.), Rotor disc loading (maximum) 9.05 kg./sq. m. (1.85 lbs./sq. ft.), Power loading (normal) 5.0 kg./CV (11 lbs./h.p.), Power loading (maximum) 6.0 kg./CV (13.2 lbs./h.p.).

PERFORMANCE (At normal loaded weight).—Maximum speed 150 km.h. (93 m.p.h.), Ceiling 3,000 m. (9,840 ft.), Range 300 km. (186 miles).

REGGIANE.

OFFICINE MECCANICHE "REGGIANE" S.A. (CAPRONI).

HEAD OFFICE AND WORKS: REGGIO EMILIA.

This concern built Caproni aeroplanes during the war 1915-18, but abandoned its aircraft department after the Armistice. It resumed aircraft manufacture in 1937 and produced a number of military aircraft, of which the Re 2000 single-seat interceptor fighter monoplane, which appeared in 1940, the Re 2001, which was developed in 1941 and the Re 2005, which appeared in 1943, were the last known. The Re 2001 and 2005 were in service in small numbers in the short-lived Fascist Republican Air Force.

In 1946 the Reggiane concern was engaged in the manufacture of railway coaches.

S.A.I.

SOCIETA AERONAUTICA ITALIANA ING. A. AMBROSINI & C.

HEAD OFFICE AND WORKS: PASSIGNANO SUL TRASIMENTO (PERUGIA).

Chief Designer: Ing Sergio Stefanutti.

This concern built light aircraft and a large number of aircraft accessories before the war. It also had interests in the former Italian colonies. During the war it was mainly engaged in sub-contract work for the principal military aircraft manufacturers, but it also designed and built two fighter aircraft, neither of which proceeded beyond the prototype stage.

The Passignano works were severely damaged by Allied bombers but they have now been re-conditioned and the company has prepared designs for several light civil aircraft for production as soon as conditions permit.

S.I.A.I.-MARCHETTI.

SOCIETA ITALIANA AEROPLANI IDROVOLANTI S.I.A.I.-MARCHETTI."

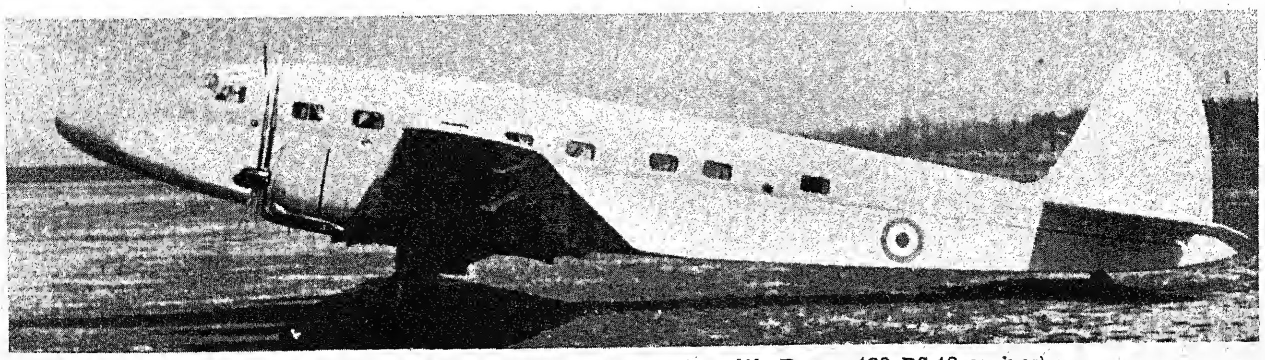
HEAD OFFICE: SESTO CALENDE.

WORKS: SESTO CALENDE AND BORGOMANERO.

The S.I.A.I.-Marchetti company, formerly known as Savoia-Marchetti, produced a wide range of military and civil aircraft covering both landplanes and flying-boats, and in later years devoted much attention to the development of the three-engined low-wing monoplane. Aeroplanes in this category include the SM.79 and SM.82 widely used by the *Regia Aeronautica* and the SM.75, SM.81 and SM.84, all of which have been described in previous issues of this work.

During the War the Company produced a number of experimental military aircraft, including the SM.91, SM.92 and SM.93, which are briefly described hereafter.

Since the War the Company has designed and gone into production with the SM.95 four-engined commercial monoplane, and begun construction of the prototype SM.101 touring monoplane. Twenty SM.95s are being built and a development of



The S.I.A.I-Marchetti SM.95 Airliner (four 930 h.p. Alfa-Romeo 128 RC.18 engines).

S.I.A.I-MARCHETTI—*continued.*

this type in all-metal construction with circular fuselage suitable for pressurisation is contemplated. The SM.102 twin-engined short-range passenger monoplane is projected. It is also engaged in the conversion of SM.79 bombers into transports; the overhaul of SM.82 and Cant Z.506 aircraft, and the construction of railway coaches. In collaboration with Alfa-Romeo the Company is building motor lorries and other road vehicles.

THE S.I.A.I-MARCHETTI SM.102.

The SM.102 is a projected twin-engined short-range transport monoplane with accommodation for a crew of two and eight passengers. It has a cantilever wing of wooden two-spar construction, and the fuselage is of steel tube with fabric covering.

The power plant is to consist of two Menasco Super-Buccaneer C65-4 six-cylinder in-line air-cooled engines each rated at 260 h.p. at 2,280 m. (7,490 ft.) and with 290 h.p. available for take-off.

Dimensions.—Span 19.70 m. (64 ft. 7¾ in.), Length 11.80 m. (36 ft. 3½ in.), Wing area 42.5 sq. m. (457 sq. ft.), Aspect ratio 9.1.

Weights and Loadings (Designed).—Weight empty 2,100 kg. (4,630 lbs.), Disposable load 1,400 kg. (3,086 lbs.), Weight loaded 3,500 kg. (7,716 lbs.), Wing loading 82.3 kg./sq. m. (16.9 lbs./sq. ft.), Power loading 6.04 kg./CV (13.34 lbs./h.p.).

Performance (Estimated).—Maximum speed 270 km.h. (168 m.p.h.) at 2,400 m. (7,870 ft.), Cruising speed (70% power) 245 km.h. (152 m.p.h.) at 3,500 m. (11,480 ft.), Landing speed 85 km.h. (53 m.p.h.), Climb to 4,000 m. (13,125 ft.) 17 minutes, Service ceiling 6,100 m. (20,000 ft.), One-engine ceiling 2,500 m. (8,200 ft.).

THE S.I.A.I-MARCHETTI SM.101.

The SM.101 is a six-seat low-wing monoplane for touring purposes. The prototype is powered by a 235 h.p. Walter Bora nine-cylinder radial air-cooled engine, which will be replaced on production aircraft by a 300 h.p. power plant of unspecified make. It is of welded steel-tube construction with fabric covering, and has a retractable landing gear. Fowler-type trailing-edge flaps are fitted to the wings.

Dimensions.—Span 16.50 m. (54 ft. 1 in.), Length 10.2 m. (33 ft. 6 in.), Height 3 m. (9 ft. 9½ in.), Wing area 29.91 sq. m. (322 sq. ft.), Aspect ratio 9.

Weights and Loadings.—Weight empty (equipped) 1,320 kg. (2,910 lbs.), Disposable load 870 kg. (1,918 lbs.), Weight loaded 2,190 kg. (4,828 lbs.), Wing loading 73.2 kg./sq. m. (15 lbs./sq. ft.), Power loading 9.3 kg./CV (20.9 lbs./h.p.).

Performance.—Maximum speed 240 km.h. (149 m.p.h.) at sea level, Cruising speed (70% power) 225 km.h. (140 m.p.h.) at 2,750 m. (9,020 ft.), Landing speed 75 km.h. (47 m.p.h.), Range 1,250 km. (777 miles), Service ceiling 4,800 m. (15,750 ft.).

THE S.I.A.I-MARCHETTI SM.95.

The SM.95 is a four-engined transport monoplane which has been built in limited numbers, and one of which was used by the Royal Air Force for V.I.P. work. The manufacturers were at the time of writing seeking permission to proceed with production of the type. The SM.95 has been built with various types of power plant, and an all-metal version with accommodation for 30 passengers is projected.

Type.—Four-engined Transport.

Wings.—Cantilever low-wing monoplane. Wooden three-spar structure with plywood skin. Wing is entirely watertight in case of emergency alighting in water. Slotted trailing-edge flaps between ailerons and fuselage. Gross wing area 128.3 sq. m. (1,380 sq. ft.).

Fuselage.—Composite structure of arc-atomically welded steel-tube framework, with light alloy covering to nose, under section, and rear section, and ply and fabric-covered sides and upper surface.

Tail Unit.—Cantilever monoplane type. Fixed surfaces of wooden construction similar to wings; steel-tube rudder with fabric covering.

Landing Gear.—Retractable two-wheel type. Main wheels each carried between pair of shock-absorber legs which retract backwards into inner engine nacelles and are partially enclosed by twin doors. Retractable tailwheel.

Power Plant.—Four Alfa Romeo 128 RC 18 nine-cylinder radial air-cooled engines each rated at 850 h.p. at 1,800 m. (5,905 ft.) and with 930 h.p. available for take-off; four Alfa Romeo 131 RC 14/15 nine-cylinder radial air-cooled engines each rated at 1,130 h.p. for take-off; four Wright R-1820 G2 Cyclone nine-cylinder radial air-cooled engines each rated at 850 h.p. at 1,770 m. (5,805 ft.) and with 1,000 h.p. available for take-off; or four Pratt & Whitney R-1830 Twin-Wasp fourteen-cylinder two-row radial air-cooled engines each rated at 910 h.p. at 3,600 m. (11,810 ft.) and with 1,055 h.p. available for take-off. Three-blade airscrews. Fuel capacity 13,500 litres (2,970 Imp. gallons) in sixteen wing tanks.

Accommodation.—Crew of five consisting of two pilots side-by-side with dual controls; flight engineer; radio-operator/navigator and steward. Main cabin has normal accommodation for eighteen passengers, six single seats on port side and six double seats on starboard, or for twenty-four passengers for short-range work. Galley and cocktail bar forward, with toilet compartment at rear. Access to main cabin by door on port side of fuselage aft of cabin.

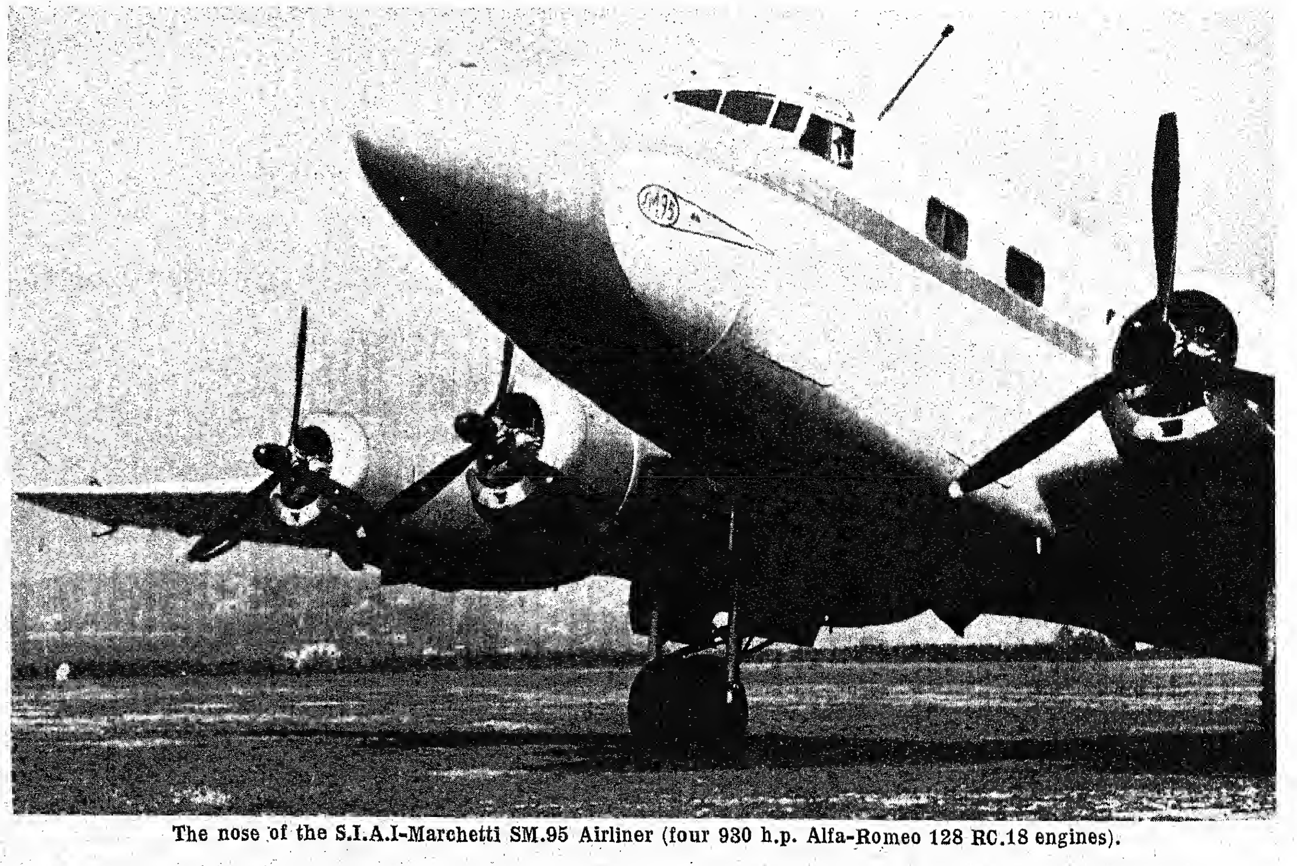
Dimensions.—Span 34.28 m. (112 ft. 5 in.), Length 22.24 m. (72 ft. 11 in.), Height 5.70 m. (18 ft. 6 in.).

Weights and Loadings (128 RC 18 engines).—Weight empty 13,000 kg. (28,660 lbs.), Payload 2,000 kg. (4,409 lbs.), Crew 425 kg. (937 lbs.), Fuel and oil 5,135 kg. (11,321 lbs.), Additional equipment 440 kg. (970 lbs.), Total disposable load 8,000 kg. (17,637 lbs.), Weight loaded (normal) 21,000 kg. (46,297 lbs.), Weight loaded with 3,000 kg. (6,614 lbs.) additional fuel 24,000 kg. (52,911 lbs.), Wing loading (normal) 163.7 kg./sq. m. (33 lbs./sq. ft.), Wing loading (overload) 187 kg./sq. m. (37.85 lbs./sq. ft.), Power loading (normal) 6.18 kg./CV (13.6 lbs./h.p.), Power loading (overload) 7.06 kg./CV (16.7 lbs./h.p.).

Weights and Loadings (Cyclone engines).—Weight empty 13,200 kg. (29,101 lbs.), Disposable load 8,000 kg. (17,637 lbs.), Weight loaded 21,200 kg. (46,738 lbs.), Wing loading 165.3 kg./sq. m. (33.9 lbs./sq. ft.), Power loading 5.3 kg./h.p. (11.68 lbs./h.p.).

Weights and Loadings (Twin-Wasp engines).—Weight empty 13,500 kg. (29,762 lbs.), Disposable load 8,000 kg. (17,637 lbs.), Weight loaded 21,500 kg. (47,399 lbs.), Wing loading 165.5 kg./sq m. (34.4 lbs./sq. ft.), Power loading 5.05 kg./h.p. (11.13 lbs./sq. ft.).

Performance (128 RC 18 engines).—Maximum speed 360 km.h. (224 m.p.h.) at 3,000 m. (9,840 ft.), Cruising speed (70% power) 300 km.h. (186 m.p.h.) at 4,100 m. (13,450 ft.), Cruising speed



The nose of the S.I.A.I-Marchetti SM.95 Airliner (four 930 h.p. Alfa-Romeo 128 RC.18 engines).

S.I.A.I-MARCHETTI—*continued.*

(60% power) 285 km.h. (177 m.p.h.), Cruising speed (50% power) 270 km.h. (168 m.p.h.), Landing speed 130 km.h. (81 m.p.h.), Climb to 1,000 m. (3,280 ft.) 3 minutes 51 seconds, Climb to 2,000 m. (6,560 ft.) 8½ minutes, Climb to 3,000 m. (9,840 ft.) 13 minutes 2 seconds, Climb to 4,000 m. (13,125 ft.) 18 minutes 47 seconds, Service ceiling 6,550 m. (21,490 ft.), Three-engine ceiling 3,660 m. (12,005 ft.), Range at 270 km.h. (168 m.p.h.) at 4,100 m. (13,450 ft.), Normal range 3,400 km. (2,113 miles), or 5,500 km. (3,417 miles) with overload, Take-off run 460 m. (503 yds.), Landing run 480 m. (525 yds.), Fuel consumption (at 70% power) 1.47 kg./km. (5.2 lbs./mile), (at 60 %power) 1.44 kg./km. (5.1 lbs./mile), (at 50% power) 1.40 kg./km. (4.95 lbs./mile).

PERFORMANCE (131 RC 14/50 engines).—Maximum speed 402 km.h. (250 m.p.h.), Cruising speed (70% power) 330 km.h. (205 m.p.h.), Cruising speed (60% power) 285 km.h. (177 m.p.h.), Cruising speed (50% power) 270 km.h. (168 m.p.h.), Climb to 1,000 m. (3,280 ft.) 2 minutes 57 seconds, Climb to 3,000 m. (9,840 ft.) 9 minutes 43 seconds, Climb to 5,000 m. (16,405 m.) 19 minutes 50 seconds, Climb to 7,000 m. (22,965 ft.) 34 minutes 1 second, Service ceiling 8,000 m. (26,245 ft.), Fuel consumption (70% power) 1.47 kg./km. (5.3 lbs./mile), (60% power) 1.42 kg./km. (5.04 lbs./mile), (50% power) 1.19 kg./km. (4.22 lbs./mile).

PERFORMANCE (Cyclone engines).—Maximum speed 350 km.h. (218 m.p.h.) at 2,400 m. (7,875 ft.), Cruising speed (70% power) 320 km.h. (199 m.p.h.) at 4,000 m. (13,125 ft.), Landing speed 130 km.h. (81 m.p.h.), Climb to 4,000 m. (13,125 ft.) 19¾ minutes, Service ceiling 6,200 m. (20,340 ft.), Three-engine ceiling 3,280 m. (10,760 ft.), Range 3,500 km. (2,175 miles).

PERFORMANCE (Twin Wasp engines).—Maximum speed 385 km.h. (239 m.p.h.) at 4,200 m. (13,780 ft.), Cruising speed (70% power) 350 km.h. (218 m.p.h.) at 4,200 m. (13,780 ft,), Landing speed 130 km.h. (81 m.p.h.), Climb to 4,000 m. (13,125 ft.) 15½ minutes, Service ceiling 7,650 m. (25,075 ft.), Three-engine ceiling 5,000 m. (16,405 ft.), Range 3,400 km. (2,113 miles).

SAIMAN.

SOCIETA ANONIMA INDUSTRIE MECCANICHE AERONAUTICHE NAVALI (SAIMAN).

HEAD OFFICE: VIA TORINO 95, ROME.

This firm was founded in 1934 in order to take over the works formerly belonging to the S.A. Navigazione Aerea, at the seaplane base at the Lido di Roma.

The Company undertook the construction, repair and maintenance of aircraft, aero-engines and motor-boats.

It produced several light aircraft of its own design. These included the Saiman 200 two-seat training biplane (200 h.p. Alfa 115 engine), the Saiman 202/1 two-seat cabin monoplane (120 h.p. Alfa 110 engine) and the Saiman 204/R four-seat cabin monoplane (180 h.p. Alfa 115 engine). These types have been described in previous issues of this Annual.

The company abandoned aircraft manufacture in September, 1943, and has not yet resumed its former activities.

SACA.

S.A. CONSTRUZIONI AERONAVALI.

HEAD OFFICE AND WORKS: BRINDISI.

Managing Director: Eng. Acampara.

This firm, which was formerly closely associated with the Aero Expresso Italiano airline, manufactured training and touring aircraft before the war. It has recently been reorganized and is preparing to resume the manufacture of light aircraft.

MEXICO

NATIONAL AIRCRAFT FACTORY.

TALLERES NACIONALES DE CONSTRUCCIONES AERONAUTICAS.

VALBUENA, MEXICO CITY.

The Mexican National Aircraft Factory was established at Valbuena, near Mexico City, in November, 1915, and from then until 1929 the factory designed and produced a number of different types of aeroplanes and aero-engines.

In 1930 the Mexican Government decided to discontinue the design and manufacture of aircraft at the National Aircraft Factory in order to encourage private enterprise, but later the Government acquired a licence to construct the Vought Corsair from the American Chance Vought Corporation, and a number of machines of this type was built at this Factory.

The Factory has recently completed a twin-engined general utility transport monoplane known as the TTS-5. This aircraft which is similar in general outline to the Beechcraft 18, is of all-wood construction and is fitted with two 200 h.p. Ranger six-cylinder in-line inverted air-cooled engines. It has accommodation for a crew of two and four passengers. The passenger seats are removable to make room for two stretchers.

On a loaded weight of 2,090 kg. (4,600 lbs.), the TTS-5 has a maximum speed of 230.4 km.h. (144 m.p.h.), a cruising speed of 208 km.h. (130 m.p.h.) and a cruising range of 1,000 km. (620 miles).

The factory is also engaged in the production of three different series of primary trainers for the Mexican Air Force.

Equipment of the factory is old and there are difficulties in replacing it with new machinery or obtaining spare parts and replacements of the existing machinery, which is mainly of either German or Japanese manufacture. Plans have been drawn up for the erection of a new factory north of Mexico City but the necessary appropriations have not yet been approved.

NETHERLANDS

N.I.V.

NETHERLANDSCH INSTITUUT VOOR VLIEGTUIGONTWIKKELING (Netherlands Aircraft Development Board).

Offices: Nieuwe Laan 76, Delft.

The Dutch Government, acting on the advice of the committee set up to investigate the possibilities and conditions for the reconstruction of the Dutch Aircraft Industry, has decided to give its financial support to the development of new aircraft types. In the name of the Minister of Transport the government advisor for the Aircraft Industry, ir. Th. P. Tromp, set up the provisional Board of the "Nederlandsch Instituut voor Vliegtuigontwikkeling" or N.I.V. (Netherlands Aircraft Development Board) on July 4, 1946.

The aim of the Board is to direct and, if necessary, to give financial support to the development of prototype aircraft as well as aircraft propulsion units, instruments, etc. in Holland. Its first task will be the planning of aircraft development in the coming years and to place the orders for prototype aircraft to be designed according to the requirements put forward in this plan. These orders will be placed either directly by the Board or in co-operation with the interested parties. The funds necessary for financing this scheme will be mainly supplied by the Dutch Government.

In order to co-ordinate the capacity of the industry and the requirements of the potential users of aircraft, both categories are represented on the Board, the members of which are, at present:—Prof. dr. ir. H. J. van der Maas, A.F.R.Ae.S. (Chairman), Lt.-Col. ir. P. J. C. Vos (Ministry of War), Dr. ir. W. T. Koiter (Ministry of Transport), Commander P. Vroon (Admiralty), Lieut.-Col. D. S. Gaastra, Royal Netherlands Indies Army Air Force (Ministry of Overseas Territories), J. de Wolf, B.A. (Ministry of Finance), E. D. M. Koning, LL.D. (Ministry of Economic Affairs), H. Veenendaal (K.L.M. Royal Dutch Airlines), ir. C. Koning (N.L.L. National Aeronautical Research Institute), J. E. van Tijen (Fokker), Ir. M. Beeling (Fokker), P. A. van der Velde (Aviolanda), Prof. ir. H. E. Jaeger (De Schelde), H. Nieuwenhuis (K.N.I.L.M. Royal Netherlands Indies Airlines), Ir. J. Blackstone.

A representative of the Nijverheidsorganisatie T.N.O. (Organisation for Applied Scientific Research) still has to be appointed.

The first three members in this list form the Executive Committee, which is assisted by a small bureau set up in Delft, where G.C. Klapwijk, LL.D. acts as secretary and ir. L. L. Th. Huls attends to the technical matters.

AVIOLANDA.

MAATSCHAPPIJ VOOR VLIEGTUIGBOUW N.V. "AVIOLANDA."

Aircraft Works: Papendrecht, near Dordrecht.

This company was formed in December, 1926, by the late H. Adolph Burgerhout. It built aircraft under licence for the Netherlands flying services, including Dornier Wal and Do 24 flying-boats for the Navy and Curtiss Hawk single-seat fighters for the East Indies Army Air Service. On the occupation of Holland all activities ceased.

In 1946, by agreement with the Fairey Aviation Co., Ltd. of England, Aviolanda undertook the production of parts and sub-assemblies for the Fairey Firefly, which aircraft has been adopted as a standard type by the Royal Netherlands Naval Air Service.

In January, 1947, the company was amalgamated with the Fokker and De Schelde companies into the N.V. Vereenigde Nederlandsche Vliegtuigenfabrieken Fokker (which see).

DE SCHELDE.

N.V. KONINKLIJKE MAATSCHAPPIJ "DE SCHELDE."

Aircraft Works: Kilkade 11, Dordrecht.

This well-known dockyard opened an aircraft department in 1935 when it took over most of the technical staff of the Pander company when this latter company closed down. The department built several light aircraft, of which the Scheldemusch single-seat biplane was, perhaps, the best known. In 1938 De Schelde undertook the construction under licence of a series of Dornier Do 24 three-engined flying-boats for the Royal Netherlands Naval Air Service. All activities ceased on the occupation of the Netherlands in 1940. Since the war the company has built eight gliders in light metal.

In January, 1947, the company was amalgamated with the Fokker and Aviolanda companies into the N.V. Vereenigde Nederlandsche Vliegtuigenfabrieken Fokker (which see).

DIEPEN.

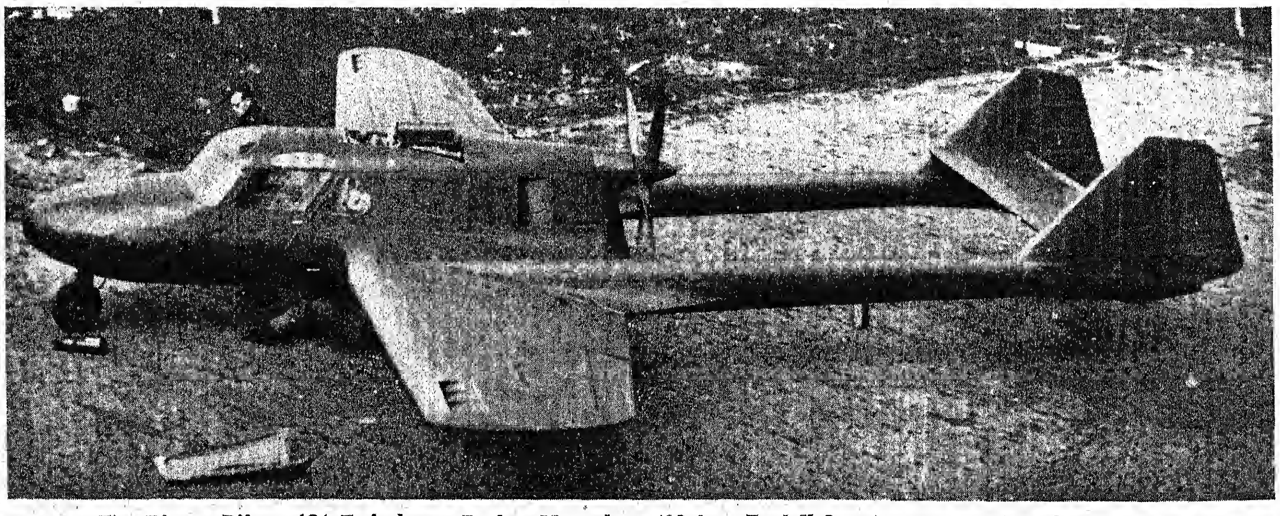
FRITS DIEPEN VLIEGTUIGEN N.V.

Head Office: Ypenburg Aerodrome, The Hague.
President: F. J. L. Diepen.
Sales Manager: E. van Beek.
Chief Engineer: Ir. H. Koekebakker.
Secretary: S. Valk.

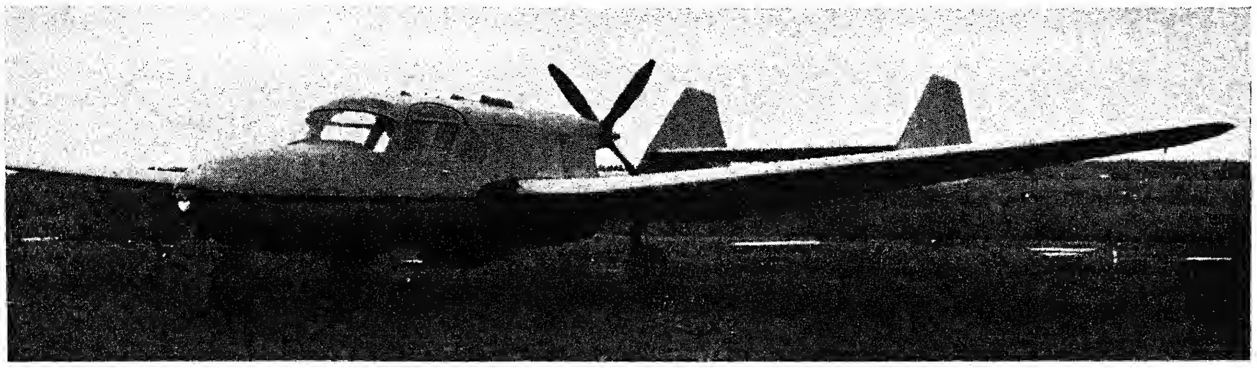
The Diepen-Difoga Model 421 twin-boom pusher monoplane was designed, during the occupation of the Netherlands, by Mr. Frits Diepen, a wealthy garage owner and private flyer, in co-operation with some engineers of the Koolhoven and Pander factories. An aircraft engine was not available so a Ford V-8 automobile engine was obtained, which largely influenced the design of the aircraft. The heaviness of the engine necessitated a long shaft drive to the propeller, and the wing area was increased over the original designed figure. Work on the prototype began secretly, and it was built in a small shop by the Difoga automobile company at Bergen-op-Zoom. The Diepen-Difoga 421, was the first new aircraft of Dutch design to fly since 1940, trial flights taking place in the Spring of 1946.

It is not proposed to produce this aircraft in series, the Frits Diepen company having been formed to undertake aircraft and engine overhaul and air-taxi work.

The Frits Diepen company has obtained the exclusive selling-rights for all countries of all new Fokker civilian designs with a total payload of up to 750 kg. (1,653 lbs.). One hundred Fokker F.25 monoplanes have been ordered by the company.



The Diepen-Difoga 421 Twin-boom Pusher Monoplane (98 h.p. Ford V-8 water-cooled automobile engine).



The Diepen-Difoga 421 Two-seat Twin-boom Cabin Monoplane (98 h.p. Ford V-8 engine).

THE DIEPEN-DIFOGA MODEL 421.

TYPE.—Two-seat twin-boom cabin monoplane.

WINGS.—Cantilever mid-wing monoplane. Structure consists of two wooden box-spars, wooden ribs and plywood covering. Slotted ailerons and mechanically-operated split trailing-edge flaps. Built-in leading-edge slots at wing tips. Wing area 24 sq. m. (258 sq. ft.).

NACELLE AND TAIL BOOMS—All-wood structures with plywood covering.

TAIL UNIT.—Twin fins built integral with tail-booms with tailplane and one-piece elevator between. Wooden structure with plywood covering. Tailplane bolted to fins. Balanced rudders and elevators have wooden frames and fabric covering. Trim-tab in port end of elevator.

LANDING GEAR.—Fixed tricycle type. Each main wheel carried on outside of single cantilever oleo-spring shock-absorber strut. Free-swivelling nose-wheel carried in fork on oleo-spring shock-absorber with pneumatic shimmy dampener.

POWER PLANT.—One Ford Mercury V-8 eight-cylinder Vee water-cooled automobile engine mounted on steel-tube bearers as pusher unit and developing 98 h.p. at 3,400 r.p.m. Four-blade fixed-pitch wooden propeller shaft-driven through specially-made gear-box with ratio of 17 : 8. Coolant radiator aft of engine with air-scoop beneath nacelle and air exits on each side of nacelle above wing. Fuel capacity 140 litres (30.8 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Access door on each side ahead of wing leading-edge. Luggage compartment aft of seats.

DIMENSIONS.—Span 13.60 m. (44 ft. 7½ in.), Length 9.60 m. (31 ft. 6 in.), Height 2.20 m. (7 ft. 2½ in.).

WEIGHTS AND PERFORMANCE.—No data available.

FOKKER.

THE N.V. VEREENIGDE NEDERLANDSCHE VLIEGTUIGENFABRIEKEN FOKKER.

HEAD OFFICE AND WORKS : PAPAVERWEG 31-33, AMSTERDAM-NOORD.

Technical Manager : Ir. M. Beeling.

The Fokker Works were founded at Amsterdam in 1919 by the late A. H. G. Fokker, the well-known aircraft designer, who died on December 23, 1939.

Up to the time of the invasion of Holland in May, 1940, the Fokker Company had produced a wide range of commercial and military aircraft of all-metal and mixed construction. Its later designs include the G.1 twin-boom Fighter-Bomber ; the D.21 fighter ; the D.23 pusher and tractor-airscrew fighter ; the T.8-W twin-engined reconnaissance seaplane, and the S.9 training biplane, details of all of which were given in the 1939 issue of "All the World's Aircraft." In 1940 the T.9 twin-engined bomber was completed and flown.

Fokker aircraft were supplied to thirty countries, eighteen of which had acquired the licence to build Fokker types. The total number of licence contracts concluded by the Company amounted to thirty-three. Over fifty air traffic companies have used Fokker civil aircraft, and many pioneering and record-breaking flights were made with Fokker aircraft all over the World.

Although the greater part of the Works was looted during the German occupation, the Fokker Company succeeded in keeping together its technical staff, and since the liberation of Holland a new four-seat taxi aircraft, the F.25, has been designed and built.

Besides repairs and conversion work for K.L.M. and the Netherlands Army and Navy, the Fokker Works are producing a series of 66 primary and advanced-training gliders for the Royal Netherlands Aero Club, and the S.9 trainer is being built for the Frits Diepen Vliegtuigen N.V. The Frits Diepen company has also placed an order for one hundred F.25s, and has obtained the exclusive selling rights for all countries of all new Fokker types with a payload of up to 750 kg. (1,653 lb.).

The Fokker company is working on the development of several new civil aircraft designs, in which the latest forms of propulsion and modern comfort developments are to be incorporated.

The Company is also engaged in the production of a small number of Koolhoven FK-43 cabin monoplanes (see "All the World's Aircraft," 1931) and Fokker S-9 two-seat training biplanes for the Dutch Government. Both types are powered by the Armstrong Siddeley Genet-Major seven-cylinder radial air-cooled engine, supplies of which had been delivered before the War for the S-9. The FK-43s are intended for the Frits Diepen charter service and are built only as interim types until the F-25 becomes available.

In January, 1947, the Fokker Aviolanda and De Schelde companies were amalgamated under the name N.V. Vereenigde Nederlandsche Vliegtuigenfabrieken Fokker, the new concern taking over all personnel and current orders of the three firms. They will continue to operate in their separate factories until a new centralised plant can be built.

THE FOKKER F-25 PROMOTER.

TYPE.—Four-seat twin-boom cabin monoplane.

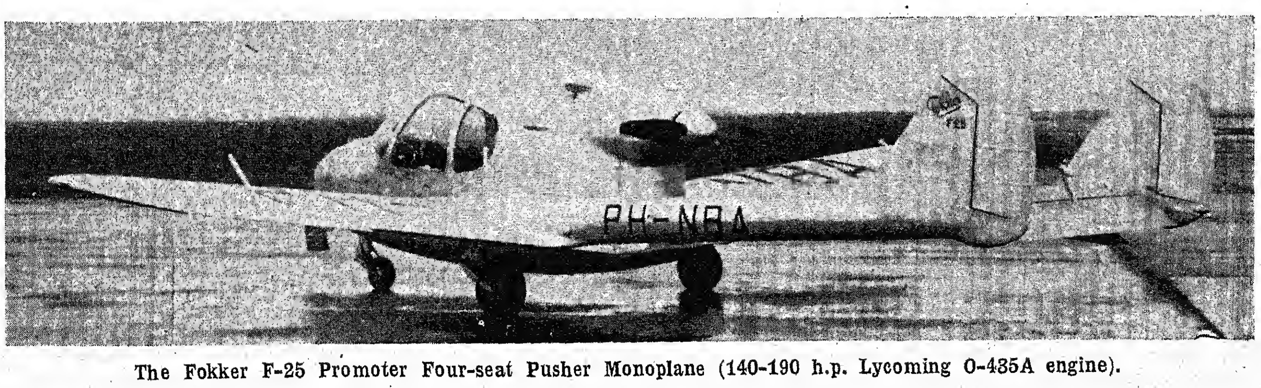
WINGS.—Cantilever low-wing monoplane. Wooden one-piece structure with two spars, plywood former ribs and plywood skin. All-wood ailerons and flaps. Flaps hydraulically-operated, with positions for take-off, landing and normal flight. Wing area 17.5 sq. m. (188 sq. ft.).

NACELLE AND TAIL BOOMS.—Wooden nacelle with light metal nose. Booms of light metal construction.

TAIL UNIT.—Twin fins and rudders with single tailplane and elevator between. Fins of metal construction ; remainder of wooden construction with fabric covering. Controllable elevator trim-tab.

LANDING GEAR.—Retractable tricycle type, main wheels retracting inwards into wing and nose-wheel forward into nacelle. Hydraulic operation. Nose-wheel steerable. Main wheels fitted with hydraulic brakes.

POWER PLANT.—One Lycoming O-435 A six-cylinder horizontally-opposed air-cooled engine rated at 140 h.p. at 2,300 r.p.m. at 1,000 m. (3,280 ft.) and with a maximum output of 190 h.p. at 2,550 r.p.m. at sea level ; or one Continental E185 six-cylinder horizontally-opposed air-cooled engine rated at 140 h.p. at 2,100 r.p.m. at 1,000 m. (3,280 ft.) and with a maximum output of 185 h.p. at 2,300 r.p.m. at sea level. Other alternative engines of 165-225 h.p. may be installed. Engine mounted as pusher unit on welded steel-tube bearer at rear of nacelle and covered with detachable metal panels. Two-blade two-position or constant-speed wooden propeller. Fuel



The Fokker F-25 Promoter Four-seat Pusher Monoplane (140-190 h.p. Lycoming O-435A engine).

FOKKER—*continued.*

tank of 200 litres (44 Imp. gallons) capacity in wing root between spars.

ACCOMMODATION.—Enclosed cabin seating pilot and three passengers. Pilot in front on port side. Single full-width passenger seat with folding armrests. Light metal access door on starboard side can be jettisoned. Plexiglas windows and moulded windshield. Space beside pilot can be used for luggage. Hinged nose, on standard aircraft, permits loading of stretcher into cabin.

EQUIPMENT.—12-volt electric system. Electric starter and generator. Radio equipment optional.

DIMENSIONS.—Span 12 m. (39 ft. 4½ in.), Length 8.5 m. (27 ft. 10½ in.) Height 2.4 m. (7 ft. 10½ in.).

WEIGHTS AND LOADINGS (Lycoming O-435 A).—Weight empty (including equipment and with allowance of 15 kg.=33 lbs. for radio) 920 kg. (2,032 lbs.), Pilot and three passengers 305 kg. (672 lbs.), Luggage 30 kg. (66 lbs.), Fuel and oil 95 kg. (210 lbs.), Weight loaded 1,350 kg. (2,980 lbs.), Wing loading 77 kg./sq. m. (15.9 lbs./sq. ft.), Power loading 7.1 kg./h.p. (15.7 lbs./h.p.).

WEIGHTS AND LOADINGS (Continental E185).—Weight empty 900 kg. (1,988 lbs.), Pilot and three passengers 305 kg. (672 lbs.), Luggage 30 kg. (66 lbs.), Fuel and oil 115 kg. (254 lbs.), Weight loaded 1,350 kg. (2,980 lbs.), Wing loading 77 kg./sq. m. (15.9 lbs./sq. ft.), Power loading 7.3 kg./h.p. (16.1 lbs./h.p.).

PERFORMANCE (Lycoming O-435 A).—Maximum speed at sea level 217 km.h. (135 m.p.h.), Cruising speed at 1,000 m. (3,280 ft.) 195 km.h. (121 m.p.h.), Landing speed 90 km.h. (56 m.p.h.), Rate of climb at sea level 168 m./min. (550 ft./min.), Climb to 1,000 m. (3,280 ft.) 6.8 minutes, Climb to 2,000 m. (6,560 ft.) 16.1 minutes. Climb to 3,000 m. (9,840 ft.) 30 minutes, Service ceiling 3,600 m. (11,810 ft.), Absolute ceiling 4,400 m. (14,400 ft.), Range, with 87 kg. (192 lbs.), fuel 515 km. (320 miles), Range with maximum fuel 850 km. (530 miles), Take-off run in 8 km.h. (5 m.p.h.) wind 230 m. (251 yds.), Landing run 150 m. (164 yds.), Fuel consumption at cruising speed, 0.235 kg./h.p. hr. (0.52 lbs./h.p. hr.).

PERFORMANCE (Continental E185).—Maximum speed 215 km.h. (134 m.p.h.), Cruising speed at 1,000 m. (3,280 ft.) 195 km.h. (121 m.p.h.), Landing speed 90 km.h. (56 m.p.h.), Rate of climb at sea level 162 m./min. (530 ft./min.), Climb to 1,000 m. (3,280 ft.) 7.2 minutes, Climb to 2,000 m. (6,560 ft.) 17 minutes, Climb to 3,000 m. (9,840 ft.), 32 minutes, Service ceiling 3,500 m. (11,480 ft.), Absolute ceiling 4,300 m. (14,100 ft.), Range with 107 kg. (236 lbs.) fuel 630 km. (390 miles), Range with maximum fuel 850 km. (530 miles), Take-off run in 8 km.h. (5 m.p.h.) wind 240 m. (262 yds.), Landing run in 8 km.h. (5 m.p.h.) wind 150 m. (164 yds.), Fuel consumption at cruising speed 0.235 kg./h.p./hr. (0.52 lbs./h.p./hr.).

THE FOKKER P.1 PARTNER.

TYPE.—Two-seat twin-boom Pusher Monoplane.

WINGS.—Cantilever low-mid-wing monoplane. All-metal constant-chord single-spar structure built in one piece. Wing area 14 sq. m. (150.64 sq. ft.).

NACELLE AND TAIL BOOMS.—Metal structure with box-section floor and vertical frames covered with metal sheet. Twin detachable tail-booms of all-metal construction extend aft from wing to carry tail-unit.

TAIL UNIT.—All-metal cantilever type with twin fins built integral with tail-booms. Horn-balanced rudders. Constant-chord tail-plane and one-piece elevator with central trim-tab.

LANDING GEAR.—Fixed tricycle type. Main wheels each carried in fork on cantilever shock-absorber leg extending downwards from beneath tail-boom attachment. Steerable nose-wheel in fork on shock-absorber leg.

POWER PLANT.—One four-cylinder air-cooled engine of unspecified make developing a maximum output of 85 h.p. at 2,575 r.p.m and a cruising output of 60 h.p. at 2,300 r.p.m. Engine mounted as pusher unit on welded steel-tube bearer and driving two-blade two-position or fixed-pitch wooden propeller.

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Plexiglas covering. Nose and roof section hinged at bottom and swings upwards and forwards for access. Luggage compartment aft of seats.

DIMENSIONS.—Span 10 m. (32 ft. 9½ in), Length 6.85 m. (22 ft. 5½ in.), Height 1.80 m. (9 ft. 2¾ in.).

WEIGHTS AND LOADINGS (Designed).—Weight empty 470 kg. (1,036 lbs.), Disposable load 230 kg. (507 lbs.), Weight loaded 700 kg. (1,543 lbs.), Wing loading 50 kg./sq. m. (10.24 lbs./sq. ft.), Power loading 8.2 kg./h.p. (18.08 lbs./h.p.).

PERFORMANCE (Estimated).—Maximum speed 180 km.h. (112 m.p.h.), Cruising speed 150 km.h. (93 m.p.h.), Climb to 1,000 m. (3,280 ft.) 8.3 minutes, Service ceiling 2,900 m. (9,515 ft.), Absolute ceiling 3,700 m. (12,140 ft.), Range 570 km. (354 miles), Take-off run on 8 km.h. (5 m.p.h.) at 160 m. (175 yds.).

THE FOKKER S.11 INSTRUCTOR.

TYPE.—Two/three-seat *Ab initio* Trainer.

WINGS.—Cantilever low-wing monoplane. Wooden one-piece structure with two box spars and plywood covering. Constant-chord centre portion and two tapered outer portions. Metal ailerons with fabric covering. Duralumin split trailing-edge flaps on centre-portion of wing; hydraulic operation. Wing area 18 sq. m. (193.68 sq. ft.).

FUSELAGE.—Welded steel-tube structure with fabric covering.

TAIL UNIT.—Braced monoplane type. Fin integral with fuselage. All-metal tailplane mounted half-way up fin and braced to fuselage by single strut on each side. Horn-balanced rudder and elevators have metal frames and fabric covering. Controllable elevator trim-tab; rudder trim-tab adjustable on ground.

LANDING GEAR.—Fixed two-wheel type. Main wheels each carried on single cantilever leg. Hydraulically-operated wheel-brakes. Steerable tail-wheel.

POWER PLANT.—One Lycoming O-435-A six-cylinder horizontally-opposed air-cooled engine rated at 190 h.p. at 2,550 r.p.m. at sea level, and with a cruising output of 108 h.p. at 2,100 r.p.m. at sea level. Engine mounted on welded steel-tube bearer and driving two-blade two-position wooden airscrew. Two fuel tanks in wings one on each side of fuselage, with total capacity of 140 litres (30.8 Imp. gallons).

ACCOMMODATION.—Two seats side-by-side with dual controls, and third seat aft, all enclosed by Plexiglas canopy which slides backwards for access. Open cockpits optional. Heavy arch between front and rear seats to protect occupants in event of nose-over landing.

DIMENSIONS.—Span 11.0 m. (36 ft. 1 in.), Length 7.80 m. (25 ft. 7 in.), Height 2.15 m. (7 ft. 0½ in.).

WEIGHTS AND LOADINGS (Designed).—Weight empty (equipped) 780 kg. (1,720 lbs.), crew (two, with parachutes) 180 kg. (397 lbs.), Fuel and oil 90 kg. (198 lbs.), Normal weight loaded 1,050 kg. (2,315 lbs.), Maximum weight loaded 1,150 kg. (2,535 lbs.), Wing loading (normal) 58.5 kg./sq. m. (12 lbs./sq. ft.), Power loading (normal) 5.55 kg./h.p. (12.23 lbs./h.p.).

PERFORMANCE (Estimated at 1,050 kg. = 2,315 lbs.).—Maximum speed 210 km.h. (130 m.p.h.) at sea level, Cruising speed 165 km.h. (103 m.p.h.) at sea level, Climb to 1,000 m. (3,280 ft.) 3.8 minutes, Climb to 2,000 m. (6,560 ft.) 8.7 minutes, Climb to 3,000 m. (9,840 ft.) 15.5 minutes, Service ceiling 4,650 m. (15,255 ft.), Absolute ceiling 5,200 m. (17,060 ft.), Range 500 km. (311 miles), Duration 3 hrs., Take-off run in 8 km.h. (5 m.p.h.) wind 135 m. (148 yds.).

THE FOKKER F.26 PHANTOM.

TYPE.—Jet-propelled Airliner.

WINGS.—Cantilever low-wing monoplane. All-metal single-spar structure consisting of centre-section integral with fuselage and two sharply-tapered outer wings. Metal ailerons, and split trailing-edge flaps between ailerons and fuselage. Wing area 45 sq. m. (484 sq. ft.).

FUSELAGE.—All-metal structure of oval cross-section.

TAIL UNIT.—All-metal cantilever monoplane type with statically and dynamically-balanced control surfaces. Trim-tab in each elevator.

LANDING GEAR.—Retractable tricycle type.

POWER PLANT.—Two Rolls-Royce Nene R.B.41 centrifugal-flow turbo-jet units suspended under and faired into fuselage, and exhausting under trailing-edge of wing. Maximum static thrust (each) 2,266 kg. (5,000 lbs.). Fuel composed of Aviation Kerosene plus 1% lubricating oil; mean specific gravity 0.806. Total capacity 4,000 litres (880 Imp. gallons) in wing tanks.

ACCOMMODATION.—Pressurized accommodation designed to maintain internal pressure of 2,500 m. (8,200 ft.) when at 12,000 m. (39,370 ft.). Crew of three. Pilot and co-pilot side-by-side with dual controls and wireless-operator aft. Main cabin accommodates 17 passengers with double row on starboard and single row on port. Toilet compartment at rear. Two luggage compartments with total capacity of 4.7 cub. m. (166 cub. ft.).

DIMENSIONS.—Span 18.20 m. (59 ft. 9 in.), Length 15.40 m. (50 ft. 6 in.).

WEIGHTS AND LOADINGS (Designed).—Weight empty (equipped) 6,300 kg. (13,889 lbs.), Crew 270 kg. (595 lbs.), 17 passengers 1,275 kg. (2,811 lbs.), Baggage 425 kg. (937 kg.), Fuel 3,230 kg. (7,121 lbs.), weight loaded 11,500 kg. (25,353 lbs.), Maximum landing weight 9,800 kg. (21,606 lbs.), Wing loading (take-off) 255 kg./sq. m. (52.4 lbs./sq. ft.).

PERFORMANCE (Estimated).—Cruising speed 800 km.h. (497 m.p.h.) at 12,000 m. (39,370 ft.), Cruising speed on one engine 500 km.h. (311 m.p.h.) at 9,000 m. (29,530 ft.), Climb to 12,000 m. (39,370 ft.) 12½ minutes, Range (with payload of 1,700 kg. = 3,750 lbs. in 50 km.h = 31 m.p.h. head-wind), 1,000 km. (621 miles).

NORWAY

HÖNNINGSTAD.

B. HÖNNINGSTAD A/S.

HEAD OFFICE AND WORKS: SKÖYEN, NEAR OSLO.

The Hönningstad A/s is a newly-formed Company, and has designed the Type 5A ten-passenger transport amphibian, a brief description of which follows.

THE HÖNNINGSTAD TYPE 5A.

The Hönningstad Type 5A is a projected all-metal commercial amphibian flying-boat to be powered by two air-cooled radial engines. It is a cantilever high-wing monoplane, the constant-chord centre-section of which has a dihedral angle, with tapered outer wings. Split trailing-edge flaps are fitted between the ailerons and the hull. The hull is a two-step structure and carries a stabilizing sponson on each side. These sponsons each contain a combined landing-wheel and ski. In the retracted position the ski fits flush with the underside of the sponson, and the wheel projects slightly below. The tail-unit is a monoplane structure, with a balanced rudder and elevators. The passenger cabin will seat ten, and the crew will consist of a pilot, co-pilot and radio-operator. The passenger seats are designed to be removed quickly so that all the cabin space can be used for freight, or for ambulance work.

DIMENSIONS.—No data available.

WEIGHTS (Designed).—Disposable load (flying-boat) 2,050 kg. (4,519 lbs.), Disposable load (amphibian) 1,690 kg. (3,726 lbs.).

PERFORMANCE (Estimated).—Maximum speed 290 km.h. (180 m.p.h.), Cruising speed 257 km.h. (160 m.p.h.), Landing speed 97 km.h. (60 m.p.h.), Service ceiling 6,000 m. (19,685 ft.), Range with ten passengers and 435 kg. (960 lbs.) fuel, 700 km. (435 miles), Range, with decreased payload and full tanks, 966 km. (600 miles), Range with extra fuel tanks 2,494 km. (1,550 miles).

NATIONAL AIRCRAFT FACTORY.

FABRICA NACIONAL DE AVIONES.

Las Parmas Airport, Lima.

The Peruvian Government Aircraft Factory was established in May, 1937, for the construction and repair of military and naval service aircraft. It was established under a Government contract with the Societa Italiana Caproni, of Milan, Italy, which company agreed to supply all the necessary plant and equipment, as well as six technical experts to supervise and operate the factory.

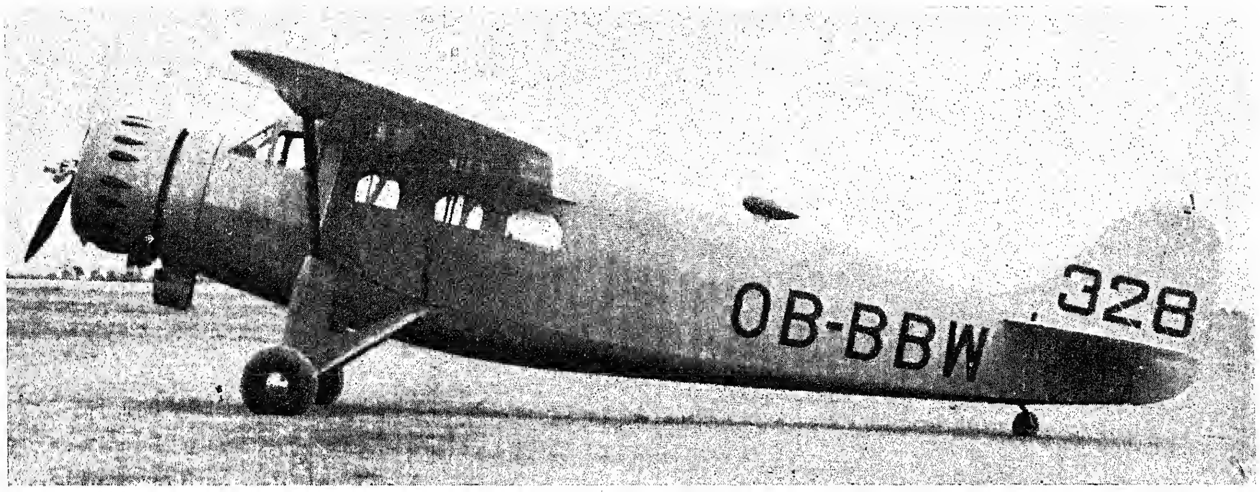
The agreement, which gave the Caproni Company a ten-year monopoly in the construction and repair of military aircraft, stipulated that the factory should produce twenty-five aircraft in the first two years. In this period only twelve Caproni Ca 100 light trainers were produced at a cost far in excess of that for which similar aircraft could be bought elsewhere.

After the outbreak of the European War the Italian Mission was withdrawn and the factory, which is said to be the largest of its kind in South America, remained inactive, except for minor repair work, until the middle of 1941.

On June 1, 1941, the Peruvian Government took the plant over at a valuation of $550,000 and now operates it as a repair and maintenance plant.

During the war the Factory built 80 Caproni Ca 100 trainers, but these have now been withdrawn from service. It is now chiefly engaged in repair and maintenance and employs about 800 personnel.

FAUCETT.



The Faucett F-19 Eight-passenger Commercial Monoplane (875 h.p. Pratt & Whitney "Hornet" engine).

CIA. DE AVIACION FAUCETT S.A.

Head Office: Edificio Hotel Bolivar No. 926, Lima.

Managing Director: Elmer Faucett.

This is the oldest aeronautical concern in Peru and apart from operating airlines and engaging in all phases of civil and commercial flying (details of which will be found in the Civil Aviation Section of this annual), it conducts an aircraft factory for the manufacture, repair and maintenance of all types of aircraft.

It has built a number of Faucett eight-seat cabin monoplanes for use on its own airlines. Its latest productions are the F-19 landplane fitted with the 875 h.p. Pratt & Whitney Hornet engine and the F-19 seaplane fitted with the 600 h.p. Pratt & Whitney Wasp engine. Both these types have also been supplied to the Peruvian Government. The F-19 was still in production in 1946.

THE FAUCETT F-19.

The F-19 is an eight-seat transport monoplane. It is of mixed construction with wooden wings and welded steel-tube fuselage and tail unit, the whole being covered with fabric.

The latest model of the F-19 is fitted with a Pratt & Whitney Hornet S1E3-G radial air-cooled geared engine and Hamilton-Standard constant-speed airscrew.

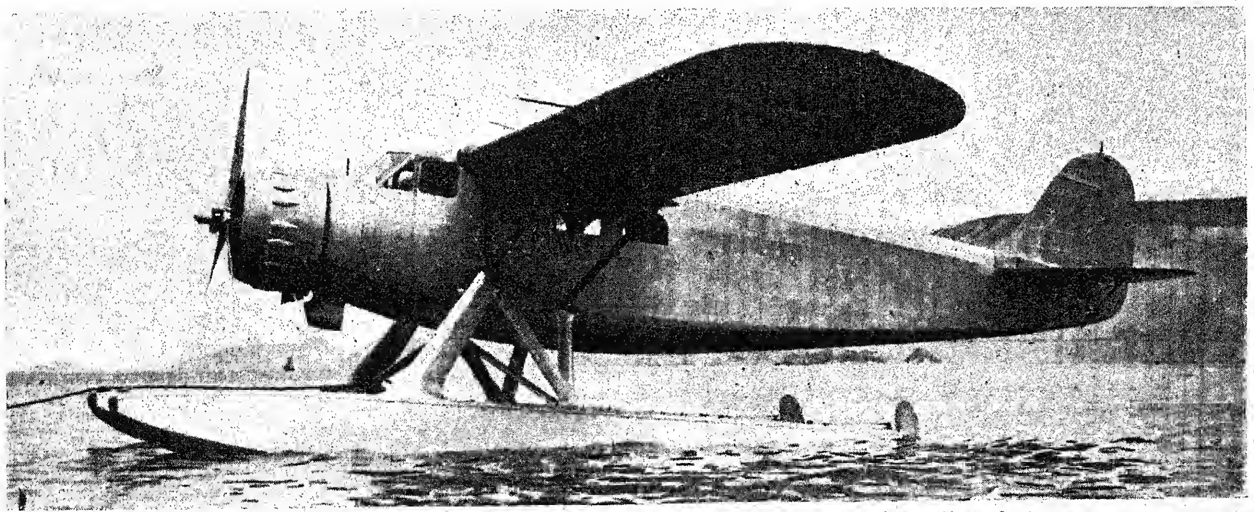
Dimensions.—Span 17.7 m. (58 ft.), Length 11.79 m. (38 ft. 8 in.), Height 4.37 m. (14 ft. 4 in.), Wing area 40.5 sq. m. (435.8 sq. ft.).

Weights and Loadings (Landplane—875 h.p. Pratt & Whitney Hornet S1E3-G engine).—Weight empty 2,581 kg. (5,690 lbs.), Pay load 850 kg. (1,874 lbs.), Disposable load 1,527 kg. (3,366 lbs.), Weight loaded 4,108 kg. (9,056 lbs.), Wing loading 109.8 kg./sq. m. (22.5 lbs./sq. ft.), Power loading 4.7 kg./h.p. (10.34 lbs./h.p.).

Weights and Loadings (Seaplane—600 h.p. Pratt & Whitney Wasp S1H1-G engine).—Weight empty 2,622 kg. (5,775 lbs.), Pay load 747 kg. (1,645 lbs.), Disposable load 1,350 kg. (2,975 lbs.), Weight loaded 3,972 kg. (8,750 lbs.), Wing loading 106.38 kg./sq. m. (21.8 lbs./sq. ft.), Power loading 6.62 kg./h.p. (14.58 lbs./h.p.).

Performance (Landplane—875 h.p. Pratt & Whitney Hornet S1E3-G engine).—Speed at sea level 264 km.h. (165 m.p.h.), Maximum speed 288 km.h. (180 m.p.h.) at 2,440 m. (8,000 ft.), Cruising speed 224 km.h. (140 m.p.h.) at 3,355 m. (11,000 ft.), Landing speed (without flaps) 112.6 km.h. (70 m.p.h.), Initial rate of climb 305 m./min. (1,000 ft./min.), Service ceiling 6,710 m. (22,000 ft.).

Performance (Seaplane—600 h.p. Pratt & Whitney Wasp S1H1-G engine).—Speed at sea level 232 km.h. (145 m.p.h.), Maximum speed 256 km.h. (160 m.p.h.) at 2,440 m. (8,000 ft.), Cruising speed at sea level 216 km.h. (135 m.p.h.), Cruising speed at 3,050 m. (10,000 ft.) 240 km.h. (150 m.p.h.), Alighting speed (without flaps) 112.6 km.h. (70 m.p.h.), Service ceiling 5,490 m. (18,000 ft.).



The Faucett F-19 Commercial Seaplane (600 h.p. Pratt & Whitney "Wasp" engine).

POLAND

The Polish Aircraft Industry is in process of organization under the control of the State and no information concerning the factories or their products is being made available for publication.

The Polish newspaper *Rzeczpospolita* for April 8, 1946, reported the baptism of the first Polish aircraft built since the war. This was a four-seat cabin monoplane known as the Szpak II and carrying the registration SP-AAA, the first civil aeroplane of the new *régime*. It was designed during the last stages of the war in Lublin by Engineers Tadeusz Soltyk, Stankiewicz and Witold Soltyk and others.

The Szpak II is of all-wood construction, has a fixed landing-gear and is fitted with a 150 h.p. Walter radial engine. The cabin seats four in two pairs, the front pair of seats being provided with dual controls. Many of the fittings appear to be improvised from ex-enemy aircraft. It has a span of 11.30 m. (37 ft.), a loaded weight of 650 kg. (1,430 lbs.) and a maximum speed of 215 km.h. (133.5 m.p.h.).

PORTUGAL

GOVERNMENT WORKSHOPS.

OFICINAS GERAIS DE MATERIAL AERONAUTICO (GENERAL AERONAUTICAL MATERIAL WORKSHOPS).

Alverca do Ribatejo.

Director: Lieut. Col. Engineer Henrique Mora.

Sub-Director and Chief Engineer: Lieut. Col. Jorge Metelo de Napoles Manuel.

This is the only establishment in Portugal manufacturing aircraft, and it belongs to the Ministry for War. Manufacture of aircraft, aero-engines and equipment is by licence. The following types have been built for the Military Aeronautical Corps:—Vickers Valparaiso, Potez XXV, Morane-Saulnier 233, D.H. Tiger Moth and Avro 626. The Bristol Jupiter and Gnôme-Rhône Titan engines which were fitted to the above types were also manufactured in this factory.

All repair and overhaul work on aeroplanes of the Air Force is done at this factory.

RUSSIA

(Union of Socialist Soviet Republics)

THE RUSSIAN AIRCRAFT INDUSTRY

The Russian State aeronautical industry comes under the direct jurisdiction of the Commissariat for Aircraft Industries.

The technical organisation is shared by three establishments, the Z.A.G.I. (Central Aero Hydrodynamics Institute) (founded in 1918), which is in charge of all aircraft development; the Z.A.I.M. (founded in 1930), which does the same for aero-engines; and the V.I.A.M. (founded in 1932), which conducts and directs research on materials.

All aircraft, aero-engine and accessory production is undertaken in State Factories. Many of these factories were originally located in the West in areas where labour and transport were readily available, but provision was made for the evacuation of those in the more vulnerable districts. All equipment and machinery was installed in easily transportable units so that it could be moved in an emergency to factories erected in safer areas. This system of evacuation was brought into use during the German invasion of Western Russia when many factories were evacuated and destroyed before the enemy's advance.

Part of the main strategic distribution of Russia's principal industries, however, has depended on the development of the vast natural resources of the inner regions of the Soviet Union and in recent years the expansion of the Aircraft Industry has mainly taken place in Central Russia and in the East.

Owing to the risk of having to fight on two fronts simultaneously the Russian Air Force has always comprised two independent Forces, one in the West and one in the Far East. This independence has even included the establishment of a separate Aircraft Industry to supply the Far Eastern Air Force.

Under the first Five-Year Plans all technical and design work was centralised, mainly at the Z.A.G.I., but more recently design work has been spread among a number of the State factories and in due course each factory will have its own design department. The work of the Russian aeronautical laboratories was, at the outset, mainly devoted to adapting the best foreign technique to Russian requirements, but in recent years a distinct individualism has been manifest in Russian aircraft design.

The organization of the production of materials for the aircraft industry is in the hands of the V.I.A.M. This, like the Z.A.G.I., has large experimental workshops in which research into foreign methods and processes have been pursued in relation to the natural resources of the U.S.S.R.

Details of the distribution of the Russian Aircraft Industry are not available for publication, but hereafter follow brief descriptions of some of the more recent types of aircraft produced in the State Factories.

Designation of Soviet Aircraft.

Two systems of naming Soviet aircraft are in use. The one in widest use is to name the type after the designer. The other system, which is now going out of use, is to name the aeroplane according to the duty it performs. The types described hereafter are given the name used officially in the U.S.S.R.

DESIGNERS:

ANT Andreas Nickolaievitch Tupolev.
IL Iliuchin.
LA Lavochkin.
PE Petlyakov.
PO Polikarpov.
YAK Yakovlev.

In some instances aircraft are designed by a committee, e.g.
LAGG—Lavochkin, Gorbunov and Gudkov.
MIG—Mikoyan and Gurevich.

DUTIES:

ARK Arctic service.
BB Close-range bomber.
DB Long-range bomber.
SB Medium bomber.
TB Heavy bomber.
I Fighter.
KOR Shipborne.
PS Transport.
UT Trainer.

RUSSIAN MILITARY AIRCRAFT.

SINGLE-ENGINE FIGHTER MONOPLANES.

THE LA-5.

Designer.—Lavochkin.

Type.—Single-seat Fighter.

Wings.—Low-wing cantilever monoplane. Wing in three sections comprising normal centre-section with two outer sections having taper on leading and trailing-edges. Structure consists of two wooden box section spars with flanges of vertically laminated plastic-bonded veneer strips. Webs and spar sheathing of three-ply birch. Plastic-bonded diagonal plywood strips form covering. Split-flaps of duralumin sheet are fitted.

Fuselage.—Triangular section wooden longerons and birch frames with skin of diagonal plywood strips. Plastic bonding used as adhesive and as impregnating medium.

Tail Unit.—Cantilever monoplane type Tailplane of similar construction to wing. Fin integral with fuselage. Control surfaces have metal frames and fabric-covering. Trim-tabs on elevators.

Landing Gear.—Retractable type. Hydraulically-operated and retracting inward and upward into recesses in front of the main spar. Oleo-pneumatic shock-absorbers. The tail-wheel is not always retracted.

Power Plant.—One 1,540 h.p. M-82F or 1,650 h.p. M-82FNU fourteen-cylinder two-row radial air-cooled engine. Bullet-proof fuel tanks, three in centre-section and one in each outer wing panel.

Accommodation.—Enclosed pilot's cockpit over trailing-edge of wing. Transparent cover slides.

Armament.—Two 20 m/m. cannon mounted above the engine. Four 110-lb. (50 kg.) bombs can be carried under the wings.

Dimensions.—Span 9.8 m. (32 ft. 2 in.), Length 8.46 m. (27 ft. 9 in)., Wing area 17.4 sq. m. (188 sq. ft.).

Weights.—No data available.

Performance.—Maximum speed 592 km.h. (370 m.p.h.) at 5,000 m. (16,400 ft.), Cruising speed 400 km.h. (250 m.p.h.), Range 640 km. (400 miles).

Remarks.—A later version of this aeroplane, known as the LA-7, has a 2,000 h.p. engine and an additional 37 m/m. cannon mounted beneath the engine. No further details are available.

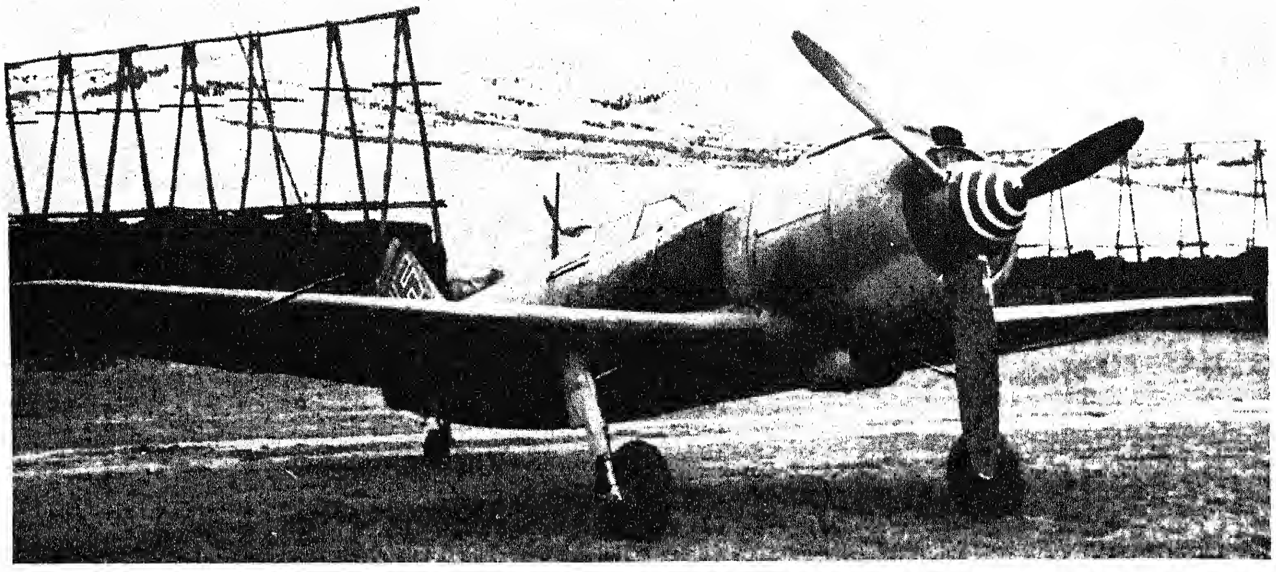
THE LAGG-3.

Designers.—Lavochkin, Gorbunov and Gudkov.

Type.—Single-seat Fighter and Fighter-bomber.

Wings.—Low-wing cantilever monoplane. Wing in three sections comprising normal centre-section with two outer sections having taper on leading and trailing-edges. Structure consists of two wooden box section spars with flanges of vertically-laminated plastic-bonded veneer strips. Webs and spar sheathing of three-ply birch. Plastic-bonded diagonal plywood strips form covering. Split-flaps of duralumin sheet are fitted.

The LA-5 Single-seat Fighter (1,540 h.p. M-82F two-row radial engine).



The LA-5 Single-seat Fighter (1,540 h.p. M-82F two-row radial engine).

FUSELAGE.—Triangular section wooden longerons and birch frames with skin of diagonal plywood strips. Plastic bonding used as adhesive and as impregnating medium.

TAIL UNIT.—Cantilever monoplane type. Tailplane of similar construction to wing. Fin integral with fuselage. Control surfaces have metal frames and fabric covering. Trim-tabs on elevators. Three types of rudder balance are known to exist.

LANDING GEAR.—Retractable type. Hydraulically-operated and retracting inward and upward into recesses in front of the main spar. Oleo-pneumatic shock absorbers. The tail-wheel is not always retracted.

POWER PLANT.—One 1,100 h.p. M-105P (cannon) twelve-cylinder 60 degree Vee liquid-cooled engine. Three-bladed all-metal Wisch-61P airscrew with hydraulic pitch control and constant-speed governor. Radiator under fuselage aft of trailing-edge. Oil radiator under front end of engine crankcase. Induction airscoops near leading-edge wing-root fillets. Bullet-proof fuel tanks, three in centre-section and one in each outer wing panel.

ACCOMMODATION.—Enclosed pilot's cockpit over trailing-edge of wing. Cockpit canopy slides and has three positions. No emergency release. Armour-plate behind seat.

ARMAMENT AND EQUIPMENT.—One 20 m/m. Shpitalny-Vladimirov motor-cannon and two 12.7 m/m. Beresin synchronised machine-guns mounted over the engine. Six 56 lb. (25 kg.) rocket-impelled fragmentation bombs can be carried on special guide-rail type racks, three under each wing.

DIMENSIONS.—Span 9,8 m. (32 ft. 2½ in.), Length 8.79 m. (28 ft. 10 in.), Wing area 17.4 sq. m. (188 sq. ft.).

WEIGHTS AND LOADINGS.—Weight empty 2,620 kg. (5,764 lb.), Weight loaded 3,200 kg. (7,040 lb.), Wing loading 181.5 kg./sq. m. (37.2 lb./sq. ft.), Power loading 2.9 kg./h.p. (6.37 lb./h.p.).

PERFORMANCE.—Cruising speed at 5,000 m. (16,400 ft.) 446 km.h. (279 m.p.h.), Maximum speed at 5,000 m. (16,400 ft.) 556.6 km.h. (348 m.p.h.), Landing speed 139 km.h. (87 m.p.h.), Climb 3,000 m. (9,840 ft.) in 5 min., Service ceiling 9,000 m. (29,520 ft.), Range 640 km. (400 miles) at 446 km.h. (279 m.p.h.), Endurance 2¼ hours.

THE MIG-3.

DESIGNERS.—Mikoyan and Gurevich.

TYPE.—Single-seat Fighter and Fighter-bomber.

WINGS.—Low-wing cantilever monoplane. Wing in three sections comprising normal centre-section with slight anhedral and large trailing-edge fillets and tapering outer sections with dihedral. The centre-section is of metal construction with metal covering and the outer sections are of wood construction with wood covering.

FUSELAGE.—Centre and forward sections of metal with light metal covering. Rear fuselage section of wood with ply covering.

TAIL UNIT.—Cantilever monoplane type. Tail-plane of metal construction with metal covering. Fin integral with fuselage. Fin and rudder of wood with wood covering. Trim-tabs on rudder and elevators.

LANDING GEAR.—Retractable type. Retracting inward and upward into recesses in front of the main spar. Hinged flaps attached to the underside of the centre-section completely cover the wheels when retracted. Retractable tail-wheel only fitted to small number of aircraft.

POWER PLANT.—One 1,200 h.p. AM-35A twelve-cylinder Vee liquid-cooled engine. Three-bladed all-metal controllable-pitch airscrew. Radiator under fuselage amidships. Induction air-scoops in leading edge roots.

ACCOMMODATION.—Enclosed pilot's cockpit over trailing-edge of wing. Transparent cover slides.

ARMAMENT AND EQUIPMENT.—According to German reports one 12.7 m/m. and two 7.7 m/m. machine-guns mounted in the nose. Six 56 lb. (25 kg.) rocket-impelled fragmentation bombs can be carried on special guide-rail type racks, three under each wing.

DIMENSIONS.—Span 11.4 m. (37 ft. 6 in.), Length 9.5 m. (31 ft. 2 in.).

WEIGHT LOADED.—About 2,820 kg. (6,200 lb.).

PERFORMANCE.—Maximum speed about 576 km.h. (360 m.p.h.), Range 800 km. (500 miles).

REMARKS.—There is a later version of this aeroplane known as the MIG-5, but no details are available.

THE YAK-1.

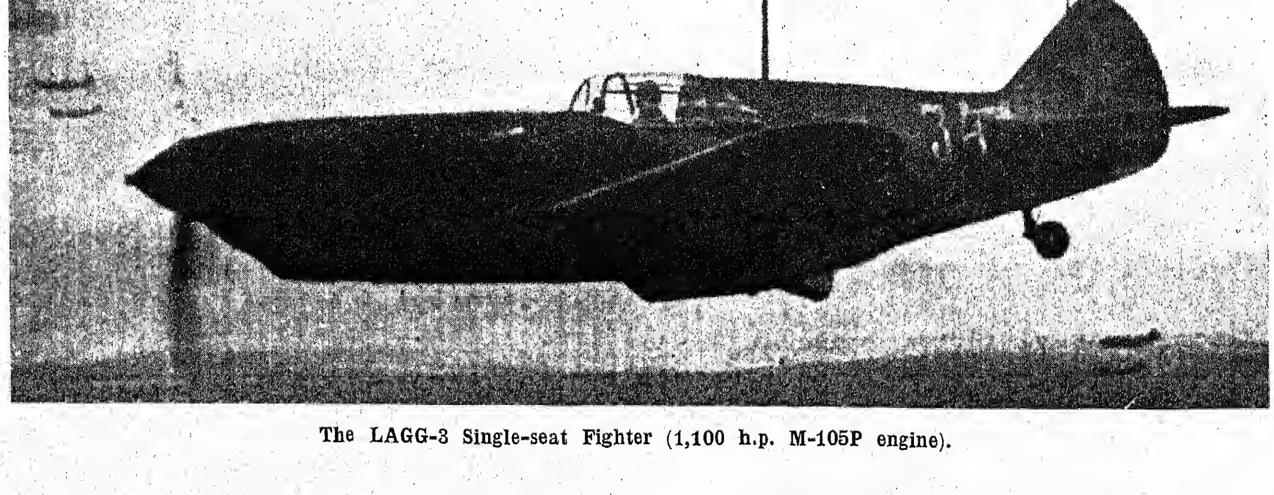
DESIGNER.—Alexander Yakovlev.

TYPE.—Single-seat Fighter.

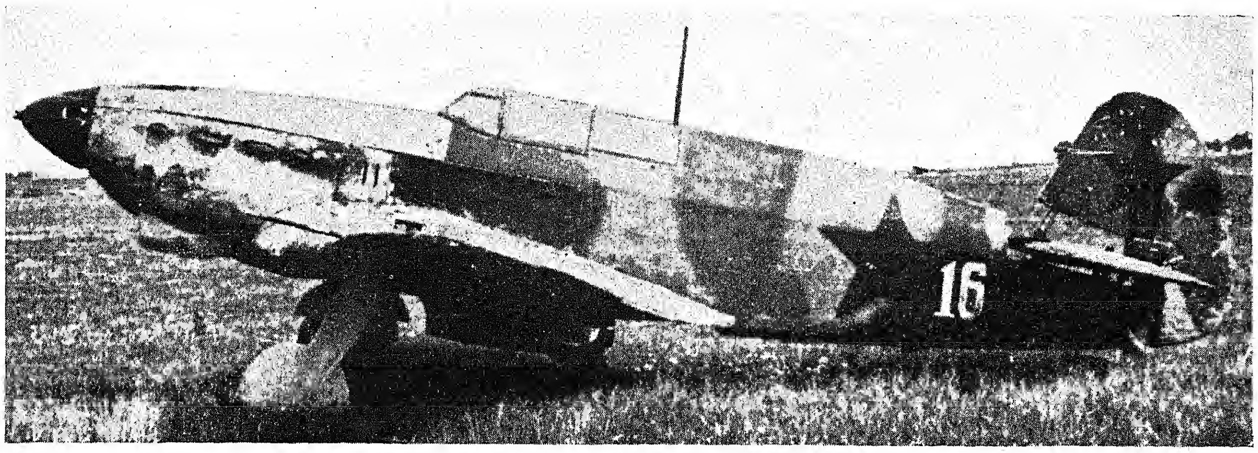
WINGS.—Low-wing cantilever monoplane. Wood structure with ply covering and fabric-covered ailerons. Sharp taper on leading and trailing-edges. Dihedral from roots. Flaps extend between fuselage and ailerons.

FUSELAGE.—Mixed construction with metal covering forward of cockpit and ply covering aft.

TAIL UNIT.—High cantilever tailplane with taper on leading-edge. Single fin and rudder. Fixed surfaces have plywood covering. Control surfaces fabric-covered. Trim-tabs in rudder and elevators.



The LAGG-3 Single-seat Fighter (1,100 h.p. M-105P engine).



The YAK-1 Single-seat Fighter (1,100 M-105 engine).

LANDING GEAR.—Inwardly retracting. Tail-wheel retracts on some versions.
POWER PLANT.—One 1,100 h.p. M-105P (cannon) twelve-cylinder Vee liquid-cooled engine. Three-bladed metal airscrew with hydraulic pitch-control and constant-speed governor. Radiator under fuselage placed far back. Oil radiator under front end of engine crankcase. Induction air-scoops in leading-edge of wing-root fillets.
ACCOMMODATION.—Enclosed pilot's cockpit over wing. Sliding cover.
ARMAMENT AND EQUIPMENT.—One 20 m/m. motor cannon and two 12.7 m/m. synchronised machine-guns mounted over the engine. Six 56 lb. (25 kg.) rocket-impelled fragmentation-bombs can be carried on special guide-rail type racks, three under each wing.
DIMENSIONS.—Span 10 m. (32 ft. 10 in.), Length 8.5 m. (27 ft. 10 in.).
WEIGHTS AND LOADINGS.—No data available.
PERFORMANCE.—Maximum speed 536 km.h. (335 m.p.h.).

THE YAK-9.

DESIGNER.—Alexander Yakovlev.
TYPE.—Single-seat Fighter.
WINGS.—Same as for YAK-1.
FUSELAGE.—Same as for YAK-1, but is shallower aft of cockpit.
TAIL UNIT.—Same as for YAK-1, but has modified trim tab in rudder.
LANDING GEAR.—Inward retracting. Retractable tail-wheel.
POWER PLANT.—One M-107 twelve-cylinder Vee liquid-cooled engine.
ACCOMMODATION.—Raised enclosed pilot's cockpit. Faired into fuselage. Sliding cover.
ARMAMENT AND EQUIPMENT.—Believed to be as for YAK-1.
DIMENSIONS.—Span 10 m. (32 ft. 10 in.), Length about 8.5 m. (28 ft.).
WEIGHTS.—No data available.
PERFORMANCE.—Maximum speed 592 km.h. (370 m.p.h.), Cruising speed 368 km.h. (230 m.p.h.), Service ceiling 9,760 m. (32,000 ft.), Range 1,040 km. (650 miles).
REMARKS.—There are two sub-types of this aeroplane. The YAK-9D is fitted with one motor cannon and two synchronised 0.50-in. machine-guns. The YAK-9T is a low attack model fitted with a 37 m/m. cannon in place of the 20 m/m. weapon.

SINGLE-ENGINED BOMBERS.
THE IL-2.

DESIGNER.—Sergei Iliuchin.
TYPE.—Two-seat Assault Bomber ("Stormovik").
WINGS.—Low-wing cantilever monoplane. Centre-section has no taper on leading-edge. Outer sections and trailing edges of centre-section have taper. Very slight dihedral from roots. Metal structure and covering. Flaps between ailerons and fuselage. Trim tabs in ailerons. Landing-light in leading-edge of port wing.
FUSELAGE.—Oval section, forward part of metal construction with metal covering. Rear fuselage of wood.
TAIL UNIT.—Cantilever tailplane with sharp taper on leading edge. Single fin and mass balanced rudder. Trim-tabs in elevators and rudder. Fixed surfaces believed to be metal-covered and movable surfaces fabric-covered.
LANDING GEAR.—Retracts backwards into large bulge under each wing leaving part of each wheel exposed. Non-retracting tail-wheel.
POWER PLANT.—One 1,300 h.p. M-38 twelve-cylinder Vee liquid-cooled engine. Three-bladed controllable-pitch metal airscrew. Radiator under fuselage. Engine has armour-plate on underside.
ACCOMMODATION.—Pilot's cockpit with raised canopy above wing with partly open cockpit for rear gunner. Armour-plate beneath and behind seat and on sides and top of cockpit cover.
ARMAMENT AND EQUIPMENT.—Two 23 m/m. cannon and two 7.6 m/m. machine-guns in the leading edge of the wing. Eight 56 lb. rocket-impelled fragmentation-bombs are carried on special guide-rail type racks, four under each wing. For special low attack missions two 37 m/m. cannon may be carried.
DIMENSIONS.—Span 14.58 m. (47 ft. 10 in.), Length 11.6 m. (38 ft.).
WEIGHTS AND LOADINGS.—No data available.
PERFORMANCE.—Maximum speed about 448 km.h. (280 m.p.h.).

TWIN-ENGINED BOMBERS.
THE DB-3F.

DESIGNER.—Sergei Iliuchin.
TYPE.—Twin-engined long-range Bomber and Torpedo-carrier.
WINGS.—Low-wing cantilever monoplane. Taper on leading and trailing-edges. Flat centre-section. Dihedral on outer sections. All-metal structure and covering. Flaps extend from ailerons to fuselage. Landing-light in leading-edge of port wing.
FUSELAGE.—Oval-section metal structure with metal covering.
TAIL UNIT.—Cantilever tailplane. Single fin and mass-balanced rudder. Trim-tabs in rudder and elevators.
LANDING GEAR.—Retracts backwards into engine nacelles leaving part of each wheel exposed. Non-retracting tail-wheel.
POWER PLANT.—Two 1,100 h.p. M.88 fourteen-cylinder radial air-cooled engines. Three-bladed metal airscrews.
ACCOMMODATION.—Pilot's enclosed cockpit above leading-edge with sliding cover. Navigator/bomb-aimer and radio-operator in glazed nose and fourth member of crew in dorsal gun-turret.
ARMAMENT AND EQUIPMENT.—Movable machine-gun in nose, movable machine-gun in dorsal turret and one in ventral position. Maximum

The YAK-9 Single-seat Fighter (1,200 h.p. M-107 engine).

The IL-2 Two-seat Ground Assault Monoplane (1,300 h.p. M-38 engine).

bomb-load believed to be 2,000 kg. (4,400 lb.) stowed in fuselage and carried on racks under wings both inboard and outboard of engines.
DIMENSIONS.—Span 21.4 m. (70 ft. 2 in.), Length 14.5 m. (47 ft. 6 in.).
WEIGHT LOADED.—15,000 kg. (33,000 lb.).
PERFORMANCE.—Maximum speed 424 km.h. (265 m.p.h.), Range 4,000 km. (2,485 miles.).

THE IL-4.

The IL-4 is an improved version of the DB-3F. It is fitted with two 1,600 h.p. M-82 two-row radial air-cooled engines. The armament consists of two machine-guns and a bomb load of 2,700 kg. (5,950 lbs.) can be carried. No other details are available.

PERFORMANCE.—Maximun speed 368 km.h. (230 m.p.h.), Cruising speed 298 km.h. (186 m.p.h.), at 7,000 m. (22,960 ft.), Service ceiling 9,000 m. (29,520 ft.), Normal Range 1,200 km. (750 miles), Maximum range (with auxiliary fuel tanks) 1,640 km. (1,025 miles).

THE PE-3.

DESIGNER.—Petlyakov.
TYPE.—Long-range Fighter, Low-level Attack and Dive-Bomber monoplane.
WINGS.—Low-wing cantiliver monoplane. Wings taper in chord and thickness from roots to tips. All-metal two-spar structure. Ailerons have servo-operated trim-tabs. Electrically-operated dive-brakes between ailerons and nacellos and nacelles and fuselage.
FUSELAGE.—Oval all-metal monocoque structure in three sections, bolted together.
TAIL-UNIT.—Cantilever monoplane type with slight dihedral and twin fins and rudders. All-metal framework with metal-covered fixed surfaces and fabric-covered elevators and rudders. Electric servo-operated trim-tabs in all movable surfaces.
LANDING GEAR.—Retractable type. Electro-hydraulic retraction for main wheels and tail-wheel, the former being raised backwards into the tails of the engine nacelles and the latter into the fuselage. Hinged doors close all apertures.
POWER PLANT.—Two M-105R twelve-cylinder Vee liquid-cooled engines with electrically-operated two-speed superchargers, each rated at 1,100 h.p. at 2,000 m. (6,560 ft.) and 1,050 h.p. at 4,000 m. (13,120 ft.) and with 1,100 h.p. available for take-off. Wisch-61 three-blade electrically-operated constant-speed airscrews. Eleven self-sealing fuel tanks in wings and fuselage. Total capacity 1,500 litres (330 Imp. gallons). Tanks are interconnected and feed to small header tank behind each engine. Inert gas fed under pressure into air spaces above fuel in tanks as a precaution against fire. Self-sealing oil tank in each engine nacelle ahead of fireproof bulkhead. Oil coolers in lower portion of each nacelle with servo-controlled exit shutters. Coolant radiators, two per engine, between wing spars with air ducts in leading-edge and air outlets in upper surface of wings. Passage of air through radiators controlled by electric servo-operated shutters.
ACCOMMODATION.—Crew of three, pilot, radio-operator and rear gunner. Pilot and radio-operator seated back to back under continuous canopy over leading-edge of wing. Radio-operator may obtain access to prone bombing position under pilot's seat. Rear gunner aft of trailing-edge of wing. All positions armoured.
ARMAMENT.—Varies according to function of aircraft. May consist of four 7.62 m/m. machine-guns, two fixed in nose of fuselage, one upper gun operated by radio-operator and one lower retractable gun aft of wings; or two 7.62 m/m. and two 12.7 m/m. machine-guns. The lower retractable gun is remotely-controlled and sighted by periscope. Bomb-bay beneath wing with accommodation for a maximum load of 1,000 kg. (2,200 lbs.). External racks under wing inboard of nacelles.
DIMENSIONS.—Span 17.16 m. (56 ft. 3 in.), Length 12.6 m. (41 ft. 6 in.), Wing area 40.5 sq. m. (436 sq. ft.).
WEIGHTS AND LOADINGS.—Weight empty 5,870 kg. (12,900 lbs.), Normal loaded weight 7,700 kg. (16,930 lbs.), Maximum permissible loaded weight 8,520 kg. (18.730 lbs.), Normal wing loading 190.3 kg./sq. m. (39 lbs./sq. ft.), Maximum wing loading 210 kg./sq. m. (43 lbs./sq. ft.).
PERFORMANCE.—Maximum speed at 5,000 m. (16,400 ft.) 540 km.h. (335 m.p.h.), Maximum speed at 2,000 m. (6,560 ft.) 506 km.h. (314 m.p.h.), Maximum speed at ground level 460 km.h. (286 m.p.h.), Cruising speed 428 km.h. (226 m.p.h.), Climb to 3,000 m. (9,840 ft.) 3.5 min., Climb to 5,000 m. (16,400 ft.) 7 min., Service ceiling 9,000 m. (29,520 ft.).

THE TU-2.

DESIGNER.—Andreas Nikolaievitch Tupolev.

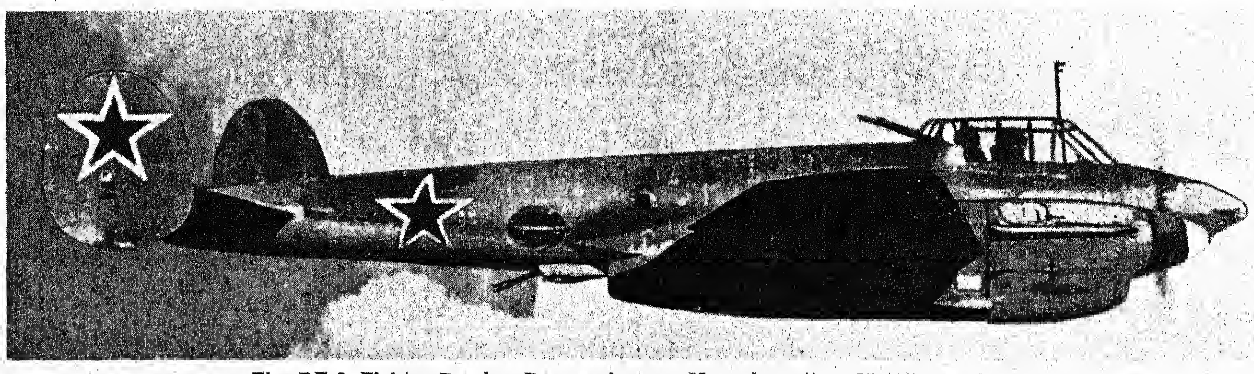
The TU-2 is a three/four-seat Attack Bomber designed to replace the PE-2. It is fitted with two 1,750 h.p. M-82 liquid-cooled engines each with one 20 m/m. motor cannon firing through the airscrew shaft. Other armament consists of four .50 in. machine-guns. one fixed in the extreme tail, and the other three on hand-operated mountings above and below the fuselage.

DIMENSIONS.—Span 21.3 m. (69 ft. 10 in.), Length 13.8 m. (45 ft. 4 in.).
WEIGHT LOADED.—12,812 kg. (28,220 lbs.).
PERFORMANCE.—Maximum speed 557 km.h. (348 m.p.h.), Cruising speed 416 km.h. (260 m.p.h.), Service ceiling 10,980 m. (36,000 ft.).

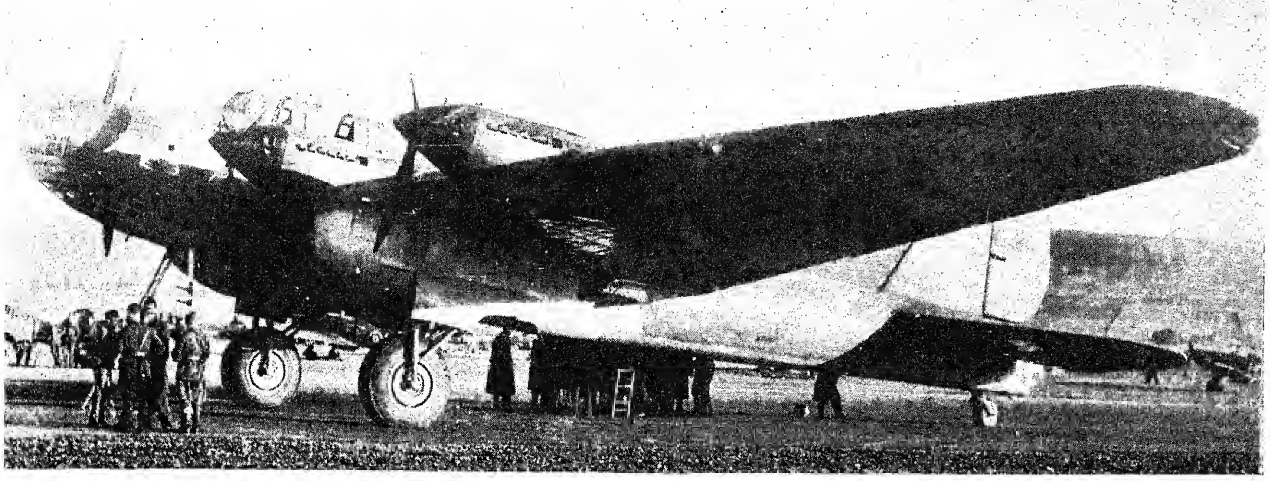
FOUR-ENGINED BOMBER.

THE TB-7.

DESIGNER.—Andreas Nikolaievitch Tupolev.
TYPE.—Four-engined Heavy-bomber.
WINGS.—Thick mid-wing cantilever monoplane. All-metal structure with taper on leading and trailing-edges. Flat centre-section between fuselage and inner engines. Marked dihedral outboard of inner engines. High aspect ratio ailerons with trim tabs. Flaps extend from fuselage to ailerons. Landing-lights in leading-edge of both wings.
FUSELAGE.—All-metal structure.
TAIL UNIT.—Cantilever tailplane with sharp taper on leading-edge. Large single fin and rudder. Trim-tabs in rudder and elevators.
LANDING GEAR.—Retracts backwards into engine nacelles leaving wheels partly exposed. Castoring non-retracting tail-wheel.
POWER PLANT.—Early version has four 1,100 h.p. M-105 twelve-cylinder upright Vee liquid-cooled engines. Later version has four 1,300 h.p. AM-38 twelve-cylinder upright Vee liquid-cooled engines.



The PE-3 Fighter-Bomber-Reconnaissance Monoplane (two M-105R engines).



The TB-7 Heavy Bomber (four 1,300 h.p. AM-38 engines).

Three-bladed controllable-pitch metal airscrews. Radiators for inner and outer engines are combined in the inner nacelles.

Accommodation.—Enclosed cockpit offset to port above wing with accommodation for first and second pilots in tandem. Radio-operator believed to be behind second pilot. Dorsal gun-turret at rear of cockpit fairing. Navigator's and bomb-aimer's positions in nose. Other members of crew in gun positions.

Armament and Equipment.—Two machine-guns in spherical turret in nose, two machine-guns in dorsal turret, 20 m/m. cannon in tail turret and one hand-operated movable machine-gun in the rear of each inboard engine nacelle under trailing-edge. Maximum bomb load of about 3,630 kg. (8,000 lb.) stowed internally in fuselage.

Dimensions.—Span 40 m. (131 ft. 3 in.), Length 24.5 m. (80 ft. 6 in.).

Weight Loaded.—About 22,250 kg. (49,000 lb.).

Performance.—Maximum speed 448 km.h. (280 m.p.h.) at 7,260 m. (25,000 ft.), Range 4,000 km. (2,500 miles) with 2,000 kg. (4,400 lb.) bomb load.

Remarks.—Also fitted with four 1,600 h.p. two-row radial air-cooled engines, but further details of this, the latest, version are not available.

FLYING BOATS.

THE GST.

Designer.—(Russian version of Consolidated PBY with modifications). Built in State Factories.

Type.—Twin-engined long-range Patrol-Bomber Flying-boat.

Wings.—Semi-cantilever high-wing monoplane. Wing in three sections, the centre-section supported above the hull by a streamline superstructure and braced by two pairs of parallel streamline struts to the sides of the hull. Wing structure is of the beam bulkhead and stressed-skin type, the skin being reinforced with "Z"-section extruded stiffeners. The trailing-edge section consists of aluminium alloy ribs cantilevered from the main beam and covered with fabric. Aluminium-alloy-framed balanced ailerons covered with fabric. An adjustable camber device is installed on the upper surface of the ailerons.

Hull.—Two-step semi-circular-topped hull of all-metal construction. Aluminium-alloy bulkheads, framing, stringers and skin. All-metal retractable wing-tip floats. When the floats are retracted they form tips to the wings and the float struts and bracing structure are recessed flush with the lower surface of the wings. Electrical and mechanically-operated retracting mechanism. Automatic locks and warning lights.

Tail Unit.—Cantilever monoplane type. Lower fin built integral with the hull. Tail-plane and upper section of fin covered with smooth metal sheet reinforced with extruded sections. Elevators and rudder are aluminium-alloy structures with fabric covering. Trimming-tabs in elevators and rudder.

Power Plant.—Two 1,000 h.p. Pratt & Whitney Twin-Wasp fourteen-cylinder radial air-cooled engines on welded steel-tube mountings in the leading-edge of the centre-section. Shuttered cowlings for Arctic use. Three-bladed metal airscrews. Fuel tanks are integral with the structure of the centre-section.

Accommodation.—Enclosed pilot's compartment seating two side-by-side with dual controls. Engineer's station in hull below centre-section. Bow gun-turret.

Armament.—Machine-gun in bow turret and probably two movable beam machine-guns, one on each side of hull aft of wing.

Dimensions.—Span 31.7 m. (104 ft.), Length 19 m. (62 ft. 6 in.), Height 5.64 m. (18 ft. 6 in.), Wing area 130 sq. m. (1,400 sq. ft.).

Weight Loaded.—12,300 kg. (27,080 lb.).

Performance.—Maximum speed 304 km.h. (190 m.p.h.), at 3,200 m. (10,500 ft.), Range 6,400 km. (4,000 miles), Climb to 1,525 m. (5,000 ft.) 4½ mins., Service ceiling 7,690 m. (25,200 ft.).

THE MBR-2.

Designer.—Blochavindin.

Type.—Single-engined Short-range Reconnaissance flying-boat.

Wings.—High-wing cantilever monoplane. Taper on leading and trailing-edges. Dihedral from roots. Square tips. Construction appears to be all-metal. Flaps are fitted. Trim-tabs in ailerons.

Hull.—Two-step all-metal hull. Braced single-step stabilizing floats are attached about halfway between the hull and wing tips.

Tail Unit.—Strut-braced tailplane. Single fin and rudder. Trim-tab in rudder.

Power Plant.—One 680 h.p. M-17 twelve-cylinder Vee water-cooled engine mounted above the hull on two sets of "N" struts. The radiator is immediately in front of the engine.

Accommodation.—Crew of five accommodated in enclosed cockpit forward of wing, midship cabin in hull, open bow gun position and dorsal gun-turret.

Armament and Equipment.—Movable hand-operated machine-gun in open bow position and one movable machine-gun in dorsal turret.

Dimensions.—Span 13.4 m. (44 ft.).

Weights and Loadings.—No data available.

Performance.—Maximum speed 217.6 km.h. (136 m.p.h.), Range 1,200 km. (745 miles).

THE MDR-6.

Designer.—Believed Blochavindin.

Type.—Twin-engined Long-range Reconnaissance flying-boat.

Wings.—High wing cantilever monoplane. Taper on leading and trailing-edges. Sharp dihedral on centre-section. Less dihedral on outer sections. Believed to be all-metal structure.

Hull.—Two-step all-metal structure. Braced single-step stabilizing floats are attached about halfway between the hull and the wing tips.

Power Plant.—Two air-cooled radial engines mounted on the leading-edge of the wing.

Accommodation.—Enclosed cockpit forward of leading-edge, bow gun-turret and dorsal gun-turret.

Armament.—No definite information but bow and dorsal-gun turrets are known to exist.

Dimensions, Weights and Performance.—No data available.

TWIN-ENGINED TRANSPORT.

THE PS-84.

Designers.—The Douglas Aircraft Company, Inc. (Russian-built Douglas DC-3 with modifications by Musalo).

Type.—Twin-engined Transport.

Wings.—Low-wing cantilever monoplane with straight trailing-edge and pronounced sweep-back to loading-edge. Dihedral on outer sections. Douglas cellular multi-web construction. Fabric-covered ailerons. Hydraulically-operated trailing-edge flaps. Detachable wing-tips. Landing-light in leading-edge of both wings.

Fuselage.—Oval-section structure built of transverse frames of formed sheet, longitudinal members of extruded bulb angles and covered with a smooth stressed skin.

Tail Unit.—Cantilever monoplane type. Tail-plane and fin of multi-cellular construction. Rudder and elevators have aluminium-alloy frames and fabric covering.

Landing Gear.—Retracts forward into engine nacelles, leaving part of each wheel exposed. Non-retracting tail-wheel.

Power Plant.—Believed to be two 1,000 h.p. M-63 air-cooled radial engines. Three-bladed metal airscrews.

Accommodation.—Enclosed pilot's compartment forward of wing. Main cabin 6 ft. 6 in. high, 7 ft. 8 in. wide and 27 ft. 8 in. long.

Armament.—Fixed machine-gun in nose, machine-gun in turret above the main cabin and two beam guns, one in each side of rear fuselage.

Dimensions.—Span 28.9 m. (95 ft.), Length 19.6 m. (64 ft. 5¼ in.), Height 5.2 m. (16 ft. 11½ in.), Wing area 91.7 sq. m. (987 sq. ft.).

Weights and Performance.—No data available but about the same as American-built DC-3.

SINGLE-ENGINED TRAINERS.

THE PO-2.

Designer.—N. N. Polikarpov.

Type.—Single-engined Training and Ambulance biplane.

Wings.—Single-bay braced staggered unequal-span biplane. Dihedral on both wings. Ailerons on both upper and lower wings. Wood structure fabric-covered.

Fuselage.—Wood construction with wood and fabric covering.

Tail Unit.—Strut-braced tailplane. Single fin and balanced rudder.

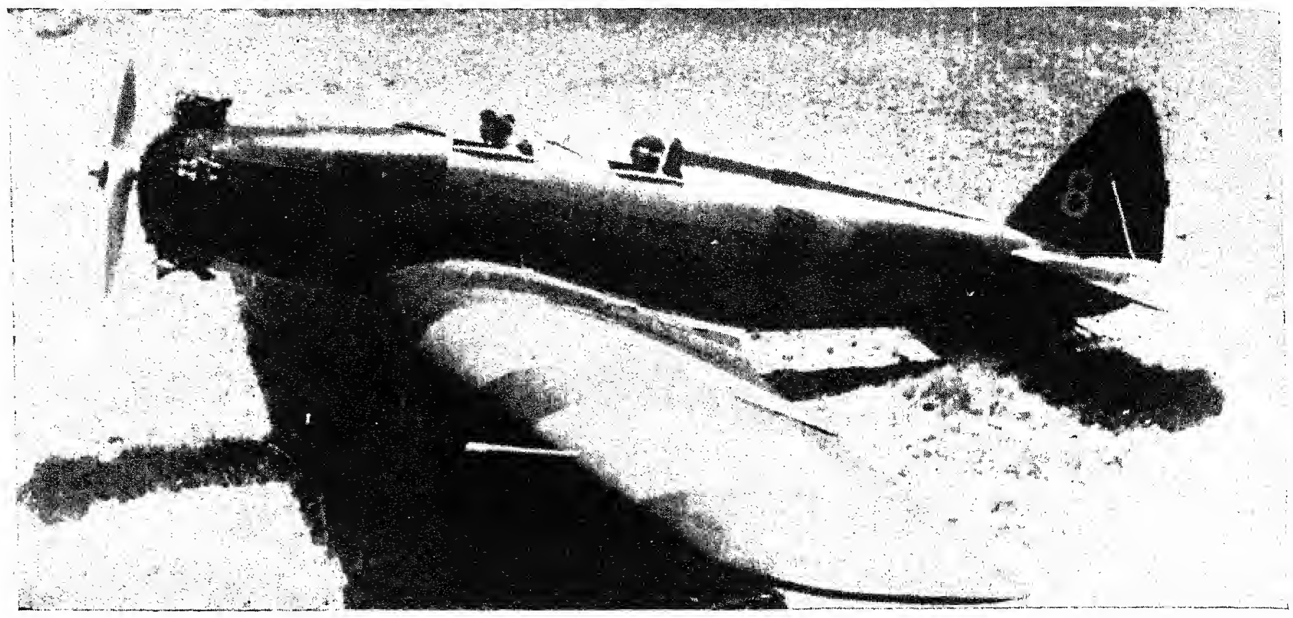
Landing Gear.—Normal non-retracting cross-axle type. Tail-skid. Can be operated on skis.

Power Plant.—One 110 h.p. M-11 five-cylinder radial air-cooled engine. Two-bladed fixed-pitch wooden airscrew. Fuel tank in centre-section of upper wing.

Accommodation.—Trainer: Tandem open cockpits with dual controls. Ambulance: Open pilot's cockpit and two stretcher containers on top of fuselage aft of cockpit. Some aircraft have three open cockpits.

Armament and Equipment.—Light bombs may be slung on racks under the lower wing.

Dimensions.—Span 11.4 m. (37 ft. 5 in.), Length 8.1 m. (26 ft. 8 in.), Height 2.9 m. (9 ft. 6 in.), Wing area 33.1 sq. m. (356.8 sq. ft.).



The UT-2 Two-seat Training Monoplane (110 h.p. M-11 engine).

Weights and Loadings.—Weight empty 605 kg. (1,331 lb.), Weight loaded 860 kg. (1,892 lb.), Wing loading 25.8 kg./sq. m. (5.3 lb./sq. ft.), Power loading 8.6 kg./h.p. (18.9 lb./h.p.).

Performance.—Maximum speed 150 km.h. (93 m.p.h.) at sea level, Landing speed 69 km.h. (43 m.p.h.), Service ceiling 4,000 m. (13,120 ft.).

THE YAK-7.

Designer.—Alexander Yakovlev.

Type.—Two-seat Advanced Training monoplane.

Wings.—Low-wing cantilever monoplane. Wood structure with ply covering. Fabric-covered ailerons. Sharp taper on leading and trailing-edges. Dihedral from roots. Flaps extend between fuselage and ailerons with hinges at right angles to line of flight.

Fuselage.—Mixed construction with metal covering forward of cockpit and ply covering aft.

Tail Unit.—Cantilever tailplane with taper on leading-edge. Single fin and rudder. Fixed surfaces have plywood-covering. Control surfaces fabric-covered. Trim-tabs in rudder and elevators.

Landing Gear.—Inwardly retracting. Non-retractable tail-wheel.

Power Plant.—One 1,100 h.p. M-105 twelve-cylinder Vee liquid-cooled engine. Three-bladed metal airscrew. Radiator under fuselage placed amidships. Oil radiator under front end of engine crankcase.

Accommodation.—Enclosed cockpit over wing. Sliding covers above seats.

Dimensions.—Span 10 m. (32 ft. 10 in.), Length about 8.5 m. (27 ft. 10 in.).

Weights and Performance.—No data available.

THE UT-2.

Designer.—Alexander Yakovlev.

Type.—Two-seat Training monoplane.

Wings.—Low-wing cantilever monoplane. Taper on leading and trailing-edges. Flat centre-section. Dihedral on outer sections. Wood structure with plywood or fabric covering.

Fuselage.—Wood structure with mixed plywood and fabric covering.

Tail Unit.—Braced monoplane type. Single fin and balanced rudder. Trim-tab on rudder.

Landing Gear.—Non-retracting split type. Tail-skid.

Power Plant.—One 110 h.p. M-11 five-cylinder radial air-cooled engine. Two-bladed fixed-pitch wooden airscrew.

Accommodation.—Tandem open cockpits with dual controls.

Dimensions and Weights.—No data available.

Performance.—Maximum speed 192 km.h. (120 m.p.h.) at sea level.

Remarks.—The UT-1 is generally similar but has only a single open cockpit for the pilot.

SPAIN

A.I.S.A.

AERONAUTICA INDUSTRIAL S.A.

Head Office and Works : Carabanchel Alto, Madrid.

This Company, with fully-equipped works and adjoining aerodrome at Carabanchel Alto (Madrid), has for some years been engaged in the design and manufacture of aircraft of mixed construction. It has been responsible for the production of several national prototypes.

In 1943, three new types were produced and put into service, the H.M.1 and H.M.5 trainers and the H.M.9 glider-tug.

THE A.I.S.A. H.M.1.

Type.—Two-seat Primary Trainer.

Wings.—Low-wing cantilever monoplane. Wings have constant taper and dihedral from root to rounded tip. All-wood structure comprising two box spars, former ribs and plywood covering. Entire trailing-edge hinged, outer sections acting as ailerons and inner sections as flaps. Flaps and ailerons have wood frames and fabric covering. Wing area 14 sq. m. (150.6 sq. ft.).

Fuselage.—Welded steel tube structure covered forward with detachable metal panels and aft with fabric.

Tail Unit.—Monoplane type. Braced tailplane and cantilever fin. Wood framework with plywood-covered fixed surfaces and fabric-covered rudder and elevators. Adjustable trimming-tabs in central surfaces.

Landing Gear.—Fixed type. Consists of two cantilever legs incorporating steel spring oil-damped shock-absorbers. Swivelling tail-wheel may be interconnected with rudder pedals by clutch when desired.

Power Plant.—One 150 h.p. Hirth HM 506 four-cylinder in-line inverted air-cooled engine on welded steel-tube mounting. Two-bladed wooden fixed-pitch airscrew. Fuel tanks in wings.

Accommodation.—Tandem open cockpits with conventional dual controls and instrument equipment.

Dimensions.—Span 9.65 m. (31 ft. 8 in.), Length 7.65 m. (25 ft.), Height 2.20 m. (7 ft. 2½ in.).

Weights and Loadings.—Weight empty 620 kg. (1,364 lbs.), Weight loaded 850 kg. (1,870 lbs.), Wing loading 60 kg./sq. m. (12.3 lbs./sq. ft.), Power loading 5.2 kg./h.p. (11.4 lbs./h.p.).

Performance.—Maximum speed 230 km.h. (142.8 m.p.h.), Cruising speed 195 km.h. (121 m.p.h.), Minimum speed 70 km.h. (43.5 m.p.h.), Climb to 1,000 m. (3,280 ft.) 3 min., Climb to 4,000 m. (13,120 ft.) 20 min., Service ceiling 5,000 m. (16,405 ft.), Duration 3.5 hours.

THE A.I.S.A. H.M.5.

Type.—Single-seat Advanced Trainer.

Wings.—As H.M.1. except that no flaps are fitted. Wing area 11.5 sq. m. (123.7 sq. ft.).

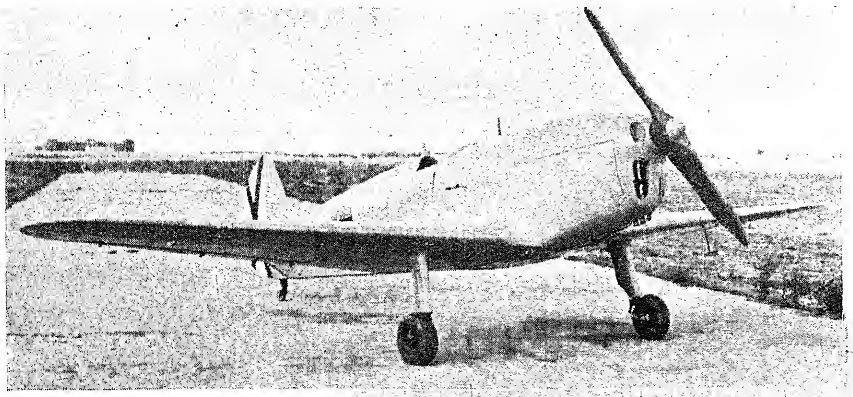
Fuselage, Tail Unit, Landing Gear and Power Plant.—As H.M.1. except that no flaps are fitted. Wing area 11.5 sq. m. (123.7 sq. ft.).

Accommodation.—Single open cockpit with conventional controls and instrument equipment.

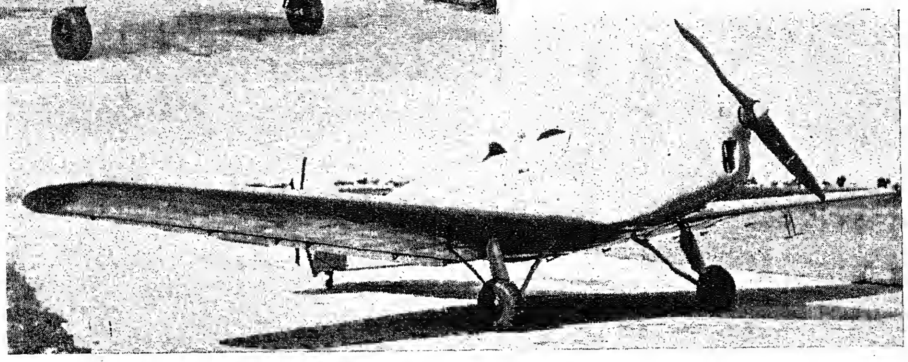
Dimensions.—Span 8.2 m. (26 ft. 10 in.), Length 7 m. (22 ft. 11 in.), Height 2.06 m. (6 ft. 9 in.),

Weights and Loadings.—Weight empty 540 kg. (1,188 lbs.), Weight loaded 680 kg. (1,496 lbs.), Wing loading 59.13 kg./sq. m. (12.12 lbs./sq. ft.), Power loading 4.2 kg./h.p. (9.24 lbs./h.p.).

Performance.—Maximum speed 240 km.h. (149 m.p.h.), Cruising speed 205 km.h. (127.3 m.p.h.), Minimum speed 75 km.h. (46.5 m.p.h.), Climb to 1,000 m. (3,280 ft.) 2 min. 40 sec., Climb to 4,000 m. (13,120 ft.) 16 min., Service ceiling 5,500 m. (18,040 ft.), Duration 2.5 hours.



The A.I.S.A. H.M.9 Glider-Tug (150 h.p. Hirth HM 506 engine).



The A.I.S.A. H.M.5 Advanced Training Monoplane (150 h.p. Hirth HM 506 engine).

THE A.I.S.A. H.M.9.

Type.—Two-seat Glider-Tug.

Wings.—As for H.M.1. Wing area 18 sq. m. (193.6 sq. ft.).

Fuselage, Tail Unit, Power Plant and Accommodation.—As for H.M.1.

Landing Gear.—Fixed type. Consists of two tripod units, the main struts with steel-spring oil-damped shock-absorbers.

Dimensions.—Span 10.65 m. (24 ft. 11 in.), Length 7.60 m. (24 ft. 11 in.), Height 2.12 m. (7 ft.).

Weights and Loadings.—Weight empty 700 kg. (1,540 lbs.), Weight loaded 920 kg. (2,025 lbs.), Wing loading 51.1 kg./sq. m. (10.47 lbs./sq. ft.), Power loading 5.7 kg./h.p. (12.5 lbs./h.p.).

Performance.—Maximum speed 175 km.h. (108.6 m.p.h.), Cruising speed 140 km.h. (87 m.p.h.), Minimum speed 60 km.h. (37.3 m.p.h.), Climb to 1,000 m. (3,280 ft.) 3 min. 20 sec., Climb to 4,000 m. (13,120 ft.) 24 min., Service ceiling 4,500 m. (14,760 ft.), Duration 2 hours.

C.A.S.A.

CONSTRUCCIONES AERONAUTICAS S.A.

Head Office : Calle de Covarrubias No. 4, Madrid.
Works : Madrid, Getafe, Seville and Cadiz.
President : Don Victor Chavarri Anduiza.
Vice-President : Don José Lacelle Larraga.
Managing Director : Don José Ortiz Echague.

This important firm has three factories wherein are built various types of all-metal military aircraft of national and foreign design for the Spanish Air Force.

Prior to the Civil War this Company, in the two factories it then possessed at Getafe and Cadiz, built 400 Breguet XIX reconnaissance biplanes, 27 Vickers Vildebeest torpedo-carrying seaplanes and 40 Dornier Wal twin-engined flying-boats for the Spanish Government.

Since the Civil War C.A.S.A. has expanded its Madrid and Cadiz factories and has built a new plant at Seville.

The Getafe factory has been engaged in the production of a series of three-engined Savoia-Marchetti aircraft and the Cadiz factory continues the production of Bücker light trainers. Heinkel He 111 twin-engined bombers are built at Seville.

LA HISPANO-AVIACION.

LA HISPANO-AVIACION S.A.

Head Office : Avenida de José Antonio No. 7, Madrid.
Aircraft Works : Seville.

This concern, which is a branch of La Hispano Suiza, Fabrica de Automoviles S.A., is devoted to the construction of aircraft. The parent company manufactures Hispano-Suiza aero-engines of both liquid and air-cooled types at its Barcelona works.

The latest original production of the Company of which details may be published is the H.S.42, a two-seat training monoplane suitable for combat or observer training. Having successfully passed all its tests the H.S.42 has been adopted by the Spanish Air Force and it is now in production in series by Hispano-Suiza.

The prototype was fitted with the 430 h.p. Piaggio P.VIIC.16 engine but this will ultimately be replaced by the new Hispano-Suiza H.S.93 engine.

In 1942 La Hispano-Aviacion was awarded a contract to manufacture a large number of fighter aircraft of an unspecified model.

***HISPANO-AVIACION**—continued.*

The Prototype Hispano-Aviacion H.S.42 Trainer with the 430 h.p. Piaggio engine and fixed landing gear.

THE HISPANO H.S.42.

TYPE.—Two-seat advanced Training monoplane.

WINGS.—Low-wing cantilever monoplane. In three sections and of all-wood construction with plywood covering. Hydraulically-operated split trailing-edge flaps. Flaps and ailerons have welded steel-tube frames and fabric covering. Wing area 16.3 sq. m. (175.4 sq. ft.).

FUSELAGE.—Oval section structure of welded steel-tube covered forward with detachable metal panels and aft with fabric.

TAIL UNIT.—Monoplane type. Metal framework with fabric covering. Adjustable tail-plane.

LANDING GEAR.—Retractable type. Wheels raised inwardly into underside of centre-section. Hydraulic retraction.

POWER PLANT.—One 430 h.p. Piaggio P.VIIC.16 seven-cylinder radial air-cooled engine driving an Alfa-Romeo electrically-operated variable-pitch airscrew. This power plant will be replaced later by the new Hispano-Suiza H.S.93 engine.

ACCOMMODATION.—Tandem enclosed cockpits under continuous canopy with sliding portions over the two seats.

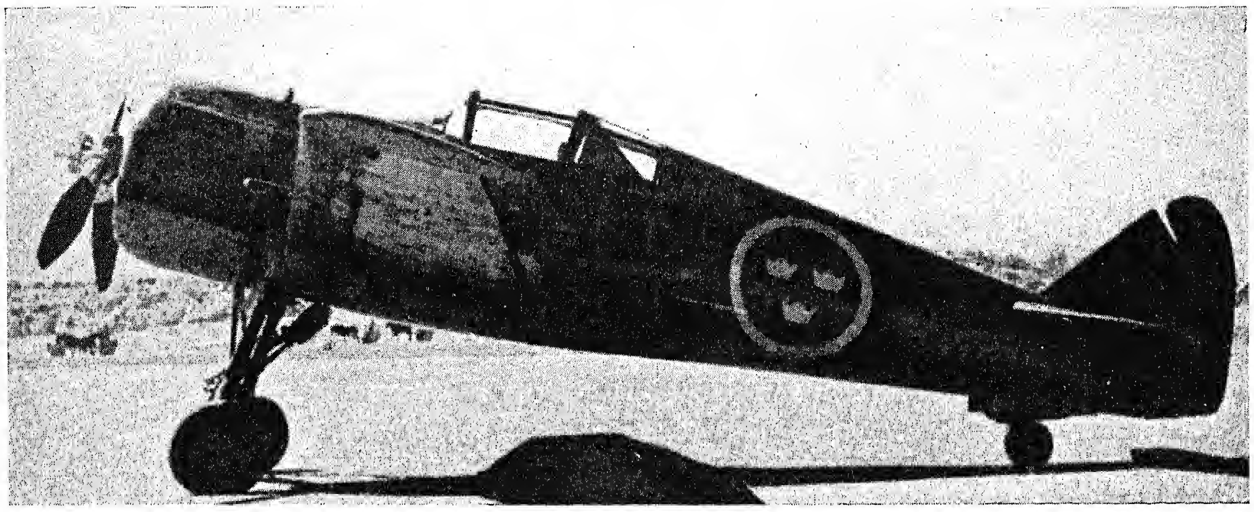
ARMAMENT.—May be equipped with fixed forward-firing gun in cowling and flexible gun in the rear cockpit.

DIMENSIONS.—Span 10 m. (32 ft. 9½ in.), Length 7.88 m. (25 ft. 10 in.),

WEIGHTS AND LOADINGS.—Weight empty 1.000 kg. (2,204 lbs.), Disposable load 500 kg. (1,102 lbs.), Weight loaded 1,500 kg. (3,307 lbs.), Wing loading 92 kg./sq. m. (18.86 lbs./sq. ft.), Power loading 3.5 kg./h.p. (7.7 lbs./h.p.).

PERFORMANCE.—Maximum speed 310 km.h. (192.5 m.p.h.), Cruising speed 280 km.h. (173.8 m.p.h.), Minimum speed 107 km.h. (66.4 m.p.h.), Climb to 3,000 m. (9,840 ft.) 10 mins., Service ceiling 6,095 m. (20,000 ft.), Duration 3 hours.

SWEDEN



The J 22 Single-seat Fighter Monoplane (Swedish-built Pratt & Whitney Twin-Wasp engine).

KUNGL. FLYGFÖRVALTNINGENS FLYGVERKSTAD.

ULVSUNDA.

Owing to the difficulty of purchasing aircraft abroad during the war and the fact that the small Swedish aircraft industry was fully engaged, the Swedish Air Board undertook the design and construction of a single-seat fighter. The design of the new fighter, designated J-22, was supervised by Mr. Bo Lundberg. Its production was handled by the Kungl. Flygförvaltningens Flygverkstad (Royal Air Board Aircraft Factory) at Ulvsunda.

THE J 22.

TYPE.—Single-seat Fighter.

WINGS.—Low mid-wing cantilever monoplane. Wings have constant taper and almost square tips. Stainless steel structure with a plywood skin. Entire trailing-edge hinged, the inner sections acting as camber-changing flaps and the outer sections as ailerons. Flaps and ailerons have spot-welded stainless steel frame and fabric-covering.

FUSELAGE.—Oval section structure having a welded steel-tube primary framework covered with birch plywood.

TAIL UNIT.—Cantilever monoplane type. Stainless steel framework with the tail-plane and fin covered with plywood and the rudder and elevators covered with fabric.

LANDING GEAR.—Retractable type. The shock-absorber legs are hinged to the lower fuselage members and retract backward into the fuselage, the hinged doors covering the apertures closing both while the landing gear is fully lowered as well as when retracted. Retractable tail-wheel.

POWER PLANT.—One 1,050 h.p. Swedish-built Pratt & Whitney Twin-Wasp two-row radial air-cooled engine enclosed in long-chord cowling with trailing-edge controllable gills. Air intake and oil cooler apertures in leading-edge of wing roots. Three-blade controllable-pitch airscrew.

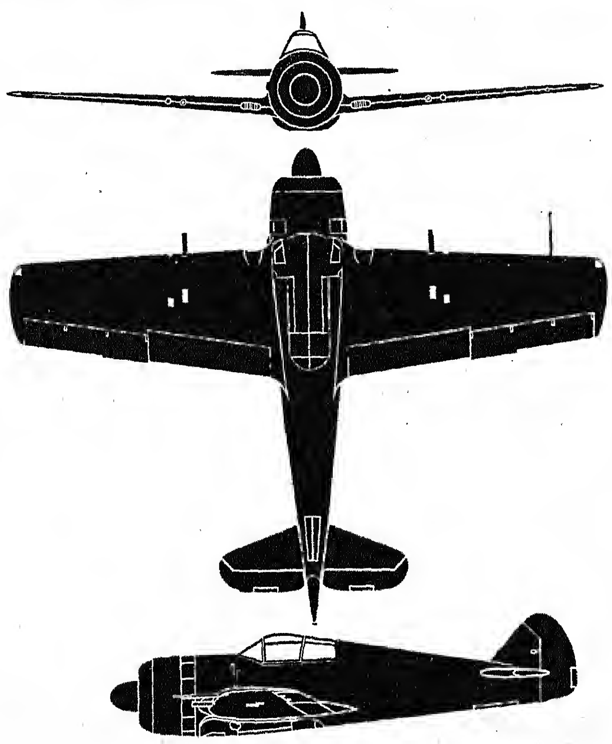
ACCOMMODATION.—Enclosed cockpit over wing.

ARMAMENT.—Two 13.2 m/m. and two 7.9 m/m. machine-guns (J 22A) or four 13.2 m/m. machine-guns (J 22B), all in the wings.

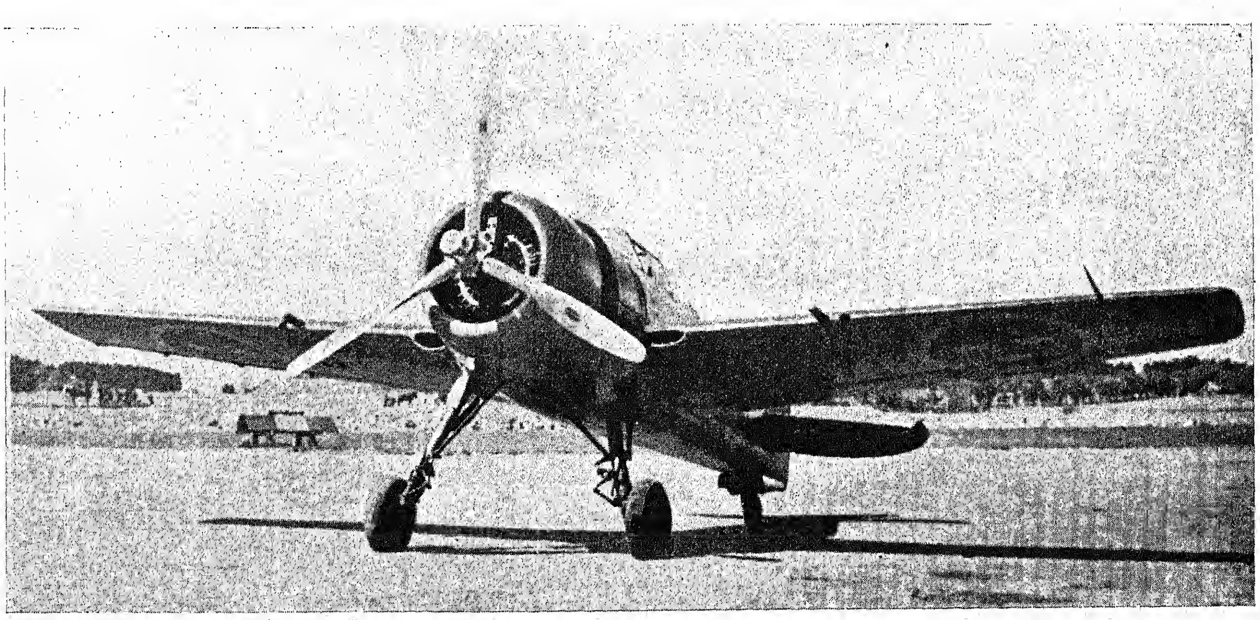
DIMENSIONS.—Span 10 m. (32 ft. 10 in.), Length 7.8 m. (25 ft. 7 in.), Height 2.9 m. (9 ft. 6 in.).

WEIGHTS.—No data available.

PERFORMANCE.—Maximum speed about 575 km.h. (360 m.p.h.), Cruising speed 450 km.h. (280 m.p.h.).



The J 22 Single-seat Fighter.



The J 22 Single-seat Fighter Monoplane (Swedish-built Pratt & Whitney Twin-Wasp engine).

BHT.

The BHT-1 Beauty Single-seat Light Monoplane (60 h.p. Walter Mikron 4 engine).

SKANDINAVISKA AERO A.B. (SCANDINAVIAN AIRWAYS, LTD.)

Head Office : Mäster Samuelsgatan 18, Stockholm.

Works : Norrtälje.

Chairman : K. R. Bökman (Managing Director of Rederi A.B. Svenska Lloyd).

Managing Director : Morten P. Hoogland.

This Company, which took over the taxi-flying business formerly operated under the name of A. B. Björkvallsflyg, undertakes freight and passenger flights on a charter basis in Europe. For this service three Douglas Dakotas are used. The company also has a number of Noorduyn Norseman and other aircraft, which are used for taxi-flights in Scandinavia, target-towing, etc.

An application by the company for Government franchise to run a number of domestic regular air routes has not yet been finally decided upon. Twin-engined aircraft would be used for these lines.

In December, 1944, the Company completed the construction of its new single-seater BHT-1 Beauty, designed by E. Bratt, K. E. Hilfing and B. Törnblom.

THE BHT-1 BEAUTY

Type.—Single-seat High-speed Fighter-Training, Target-towing and Long-Range Light monoplane.

Wings.—Low-wing cantilever monoplane. Tapering wing in three sections. Wooden two-spar structure with plywood covering. Slotted flaps and ailerons. Wing area 7 sq. m. (75.3 sq. ft.).

Fuselage.—Wooden monocoque structure with a stressed plywood skin.

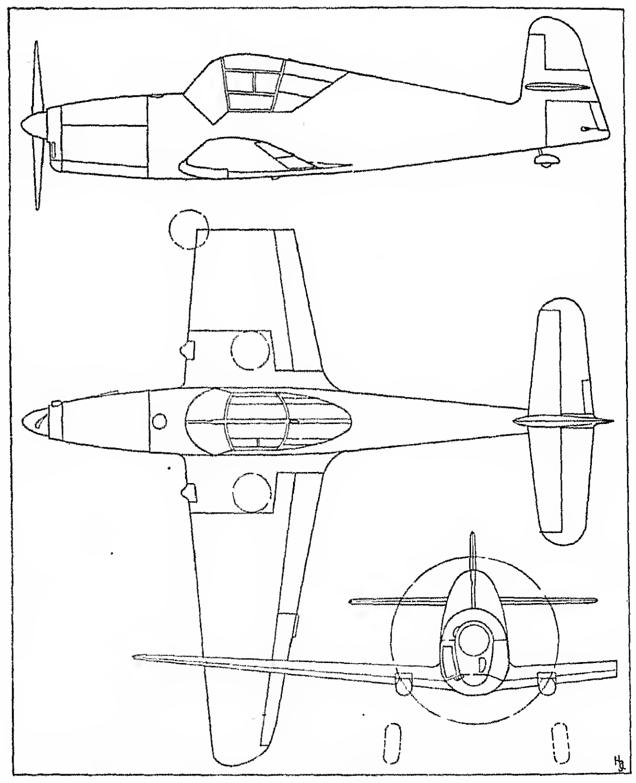
Tail Unit.—Cantilever monoplane type with aerodynamically and mass-balanced rudder and elevators with controllable trimming tabs. Tailplane and elevator are halfway up the fin, and the rudder therefore is divided. The hinges of elevator and rudder consist of plywood-tubes, at the same time functioning as spars.

Landing Gear.—Retractable type with springing and oleo damping. Wheels raised backwards, at the same time turned 90 degrees, and retracted completely into centre-section of the wing. Hand-operating gear. Metal fairings follow the legs. Wheel-brakes. Full-swivelling tail-wheel.

Power Plant.—One 60 h.p. Walter Mikron 4 four-cylinder in-line inverted air-cooled engine on a duralumin and steel-tube mounting. The 90 h.p. Cirrus-Minor or the 105 h.p. Hirth HM 504A-2 engine can also be installed with only slight alterations. Wooden fixed-pitch airscrew, with provision for controllable-pitch airscrew. Oil tank in fuselage. Fuel tanks in fuselage (38 litres = 8 Imp. gallons) and wings (two of 25 litres = 5.5 Imp. gallons each). Special reserve fuel tank (127 litres = 28 Imp. gallons) can be installed behind the pilot in luggage compartment. Maximum capacity 215 litres (47 Imp. gallons) sufficient for 3,000 km. (1,860 miles) range.

Accommodation.—Enclosed cabin of "Astralon" over centre-section, opening to starboard. Adjustable seat designed for seat-type parachute. Adjustable rudder-pedals. Cabin-roof jettisonable. Turn-over post behind pilot's seat.

Dimensions.—Span 6.82 m. (22 ft. 4½ in.), Length 5.80 m. (19 ft.), Height 1.90 m. (6 ft. 3 in.).



The BHT-1 Beauty Single-seat Monoplane.

Weights and Loadings.—Weight empty 240 kg. (528 lbs.), Weight loaded (aerobatic) 365 kg. (803 lbs.), Maximum weight loaded (for long-range flights) 420 kg. (924 lbs.), Wing loading (aerobatic) 52 kg./sq. m. (10.6 lbs./sq. ft.), Power loading 6.10 kg./h.p. (13.42 lbs./h.p.).

Performance (60 h.p. Walter Mikron 4 engine).—Maximum speed 250 km.h. (155 m.p.h.), Cruising speed 210 km.h. (130 m.p.h.), Landing speed (with flaps) 75 km.h. (46.5 m.p.h.) without flaps 95 km.h. (59 m.p.h.), Initial rate of climb 312 m./min. (1,024 ft./min.) (with 105 h.p. Hirth H.M. 504A-2 engine) 540 m./min. (1,770 ft./min.), Maximum permissable diving speed (with controllable pitch airscrew) 580 km.h. (335 m.p.h.), Service ceiling 7,500 m. (24,600 ft.), Take-off run 100 m. (98.4 yds.), Landing run 80-90 m. (78-88 yds.), Range with standard fuel capacity 1,700 km. (1,056 miles), Range with special reserve fuel 3,000 km. (1,860 miles).

SAAB.

SVENSKA AEROPLAN A.B. (SAAB).

Head Office : Linköping.

Works : Linköping and Trollhättan.

Managing Director : R. Wahrgren.

Deputy Managing Director : S. Otterbeck.

Technical Manager : E. Nordquist.

Works Manager (Linköping) : H. Bertler.

Works Manager (Trollhättan) : E. Rydberg.

Chief Design Engineers : B. Bjurströmer and A. J. Andersson.

This Company, which was formed in 1937, has emerged from a concern with the same name which originally included in its organization the Svenska Flygmotor A.B. (now an independent firm), the Svenska Aeroplan A.B. at Trollhättan and the Aeroplane Division of the A.B. Svenska Järnvägsverkstaderna at Linköping.

This Trollhättan factory has built the Junkers Ju 86 twin-engined bomber under licence as well as air-cooled aero-engines.

The Linköping factory has produced both the NA-16 trainer

***SAAB**—continued.*

and the Douglas (Northrop) 8A-1 single-engined light bomber under licence.

Since 1940 the Company, whose share capital has been increased to Kr. 21,000,000, has engaged in the production of all-metal military aircraft of its own design for the Swedish Air Force. The first of these was the two-seat single-engined Saab-17 Dive-Bomber (Air Force designation B17) or Reconnaissance (Air Force designation S17) monoplane, and this has been followed by the Saab-18 twin-engined Light-Bomber (Air Force designation B18) or Long-Range Reconnaissance (Air Force designation S18) monoplane, and the Saab-21A (J21A) single-seat Fighter monoplane.

The projected Saab-19, Saab-23 and Saab-24 military aircraft were not completed.

In 1944, the Svenska Aeroplane A.B. undertook the conversion of a number of interned Boeing B-17 Flying Fortresses into passenger aircraft for the use of A.B.A., S.I.L.A. and D.D.L. This conversion work, which was described in the 1945-46 issue of this Annual, has now ceased, and the company is now producing a three-seat cabin monoplane known as the Saab-91 Safir for civilian use, together with the Saab-90 Scandia, a twin-engined 24/32-passenger airliner with a tricycle landing-gear.

THE SAAB-90 SCANDIA.

Type.—Twin-engined 24/32-passenger airliner.

Wings.—All-metal cantilever low wing monoplane. Wing consists of constant-chord centre-section carrying engine nacelles, and two tapered outer sections. Stressed metal skin. Dihedral from roots. Aspect ratio 9.15. Gross wing area 922 sq. ft. (85.7 sq. m.). Metal ailerons, with trim-tab in port aileron. Aileron area (each) 66.7 sq. ft. (6.20 sq. m.) Split trailing-edge flaps extend under fuselage between ailerons. Landing position 45 degrees. Total flap area 166.78 sq. ft. (15.50 sq. m.).

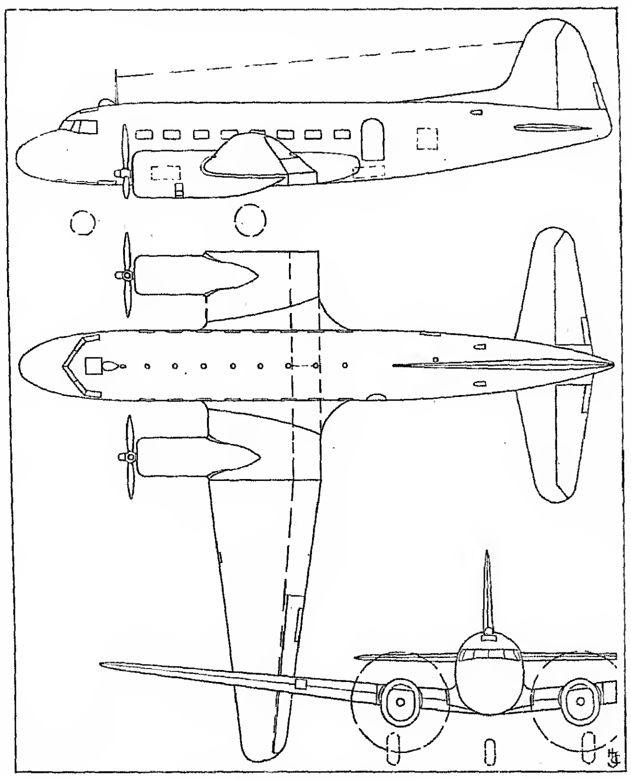
Fuselage.—All-metal monocoque structure with stressed metal skin.

Tail Unit.—Cantilever monoplane type. Trim-tabs in elevators and rudder. Tailplane span 31 ft. 9½ in. (9.70 m.), Tailplane area 209.82 sq. ft. (19.5 sq. m.), Fin area 115 sq. ft. (10.70 sq. m.).

Landing Gear.—Retractable tricycle type, all wheels retracting forward, main wheels into nacelles and nose-wheel into fuselage. Hydraulic operation. Wheel track 22 ft. 11 in. (7.0 m.), wheel base 19 ft. 4½ in. (5.90 m.).

Power Plant.—Two Pratt & Whitney R-2000-2SD13-G Twin-Wasp fourteen-cylinder radial air-cooled engines, each rated at 1,200 b.h.p. at 2,550 r.p.m. at 5,000 ft. (1,525 m.), and with 1,450 b.h.p. at 2,700 r.p.m. available for take-off. Three-blade airscrews. Fuel tanks in outer wing sections with capacity of 638 Imperial gallons (2,900 litres). Emergency jettison gear. Oil capacity 48 Imperial gallons (220 litres).

Accommodation.—Crew of four consisting of pilot, co-pilot, radio-operator and steward. Aft of pilot's compartment is main passenger cabin with 24 seats arranged in 8 pairs on starboard side and 8 single seats on port, or alternatively 32 seats arranged in 8 slightly staggered pairs on each side of central aisle. Entry door on port side; bottom of door 8 ft. 2½ in. (2.5 m.) from ground. Aft of main cabin is galley (on starboard side) with door into rear freight compartment, and lavatory (on port side). Main freight compartment of 226 cub. ft. (6.4 cub. m.) capacity is aft, with loading door on starboard side. Forward freight compartment under cabin floor ahead of wing has capacity of 81 cub. ft. (2.3 cub. m.), loading door on port side. Middle freight compartment under floor aft of wing with capacity of 70 cub. ft. (2.0 cub. m.) and loading door on port side. Total freight capacity 378 cub. ft. (10.7 cub. m.).

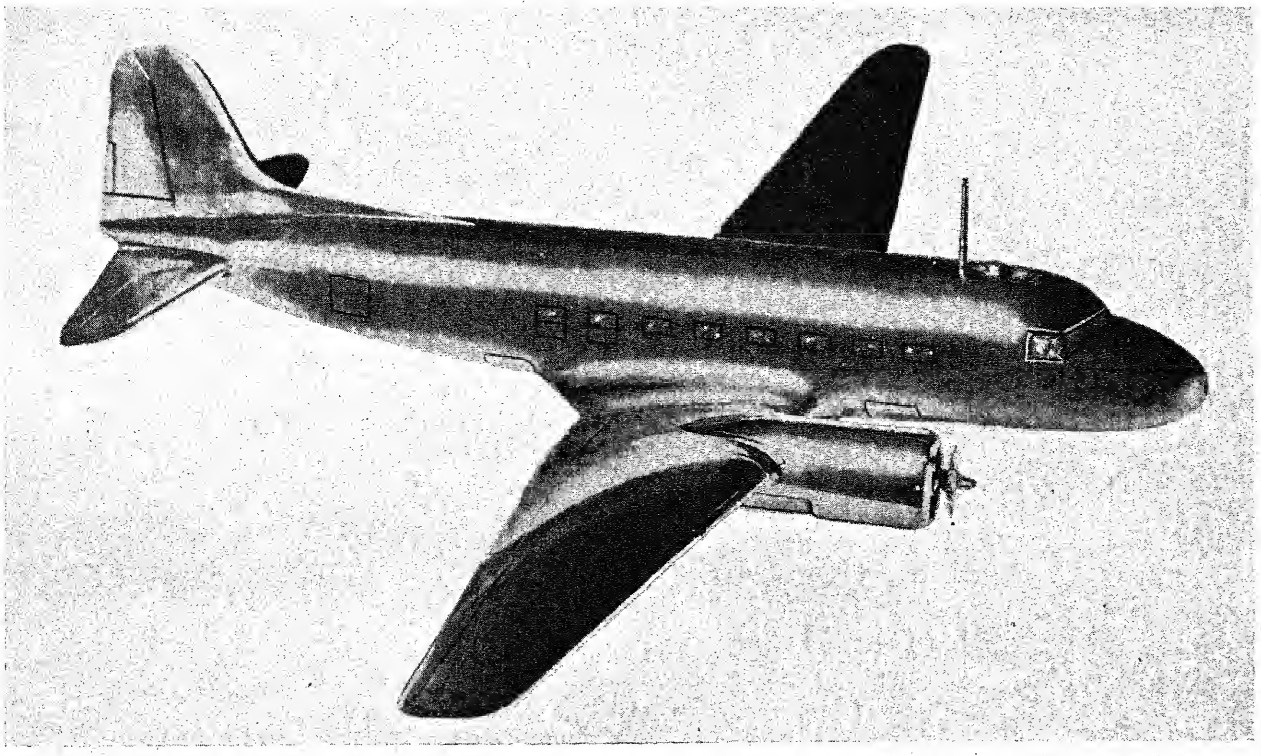


The Saab-90 Scandia.

Dimensions.—Span 91 ft. 10 in. (28 m.), Length 69 ft. 2½ in. (21.1 m.), Height 24 ft. 3 in. (7.4 m.).

Weights and Loadings.—Weight empty 18,905 lbs. (8,575 kg.), Weight empty, equipped, 19.786 lbs. (8,975 kg.), Disposable load 10,218 lbs. (4,635 kg.), Weight loaded 30,004 lbs. (13,610 kg.), Wing loading 32.12 lbs./sq. ft. (159 kg./sq. m.), Power loading (take-off power) 10.36 lbs./h.p. (4.7 kg./h.p.).

Performance (Estimated—fully loaded).—Maximum speed 251 m.p.h. (404 km.h.) at 6,800 ft. (2,073 m.), Speed at sea level 234 m.p.h. (377 km.h.), Cruising speed (70% power—840 h.p. per engine)



A photograph of a model of the Saab-90 Scandia Commercial Airliner (two 1,200-1,450 h.p. Pratt & Whitney R-2000-2SD13-G Twin-Wasp engines).

***SAAB**—continued.*

The Saab-91 Safir Three-seat Cabin Monoplane (145 h.p. D.H. Gipsy Major 10 engine).

221 m.p.h. (356 km.h.) at 10,000 ft. (3,050 m.) at sea level 202 m.p.h. (326 km.h.), Cruising speed (60% power—720 h.p. per engine) 206 m.p.h. (331 km.h.) at 10,000 ft. (3,050 m.), Stalling speed 75 m.p.h. (120 km.h.), Approach speed at sea level 97 m.p.h. (156 km.h.), Rate of climb at sea level 1,207 ft./min. (368 m./min.), At sea level on one engine 269 ft./min. (82 m./min.) at 5,000 ft. (1,525 m.) 1,148 ft./min. (350 m./min.) at 5,000 ft. (1,524 m.) on one engine 223 ft./min. (68 m./min.) at 14,000 ft. (4,360 m.) 873 ft./min. (266 m./min.) at 14,000 ft. (4,360 m.) on one engine 66 ft./min. (20 m./min.), Service ceiling 27,887 ft. (8,500 m.), One-engine ceiling 10,826 ft. (3,300 m.), Maximum range (approximate) with 24 passengers 957 miles (1,540 km.) with 32 passengers 711 miles (1,145 km.), Take-off distance to 50 ft. (15.24 m.) (fully loaded) 2,789 ft. (850 m.), Landing distance from 50 ft. (15.24 m.) 2,000 ft. (610 m.).

THE SAAB-91 SAFIR.

TYPE.—Three-seat Low-wing Cabin monoplane.

WINGS.—Cantilever low-wing monoplane. Single-spar structure in two detachable sections bolted to fuselage. Metal covering in front of spar and fabric aft. Aspect ration 8.3; taper ratio 1 : 0.45. Wing area 146.3 sq. ft. (13.60 sq. m.). Ailerons have Alclad-structure with fabric covering. Balance tab in port aileron adjustable on ground. Mechanically-operated all-metal split trailing-edge flaps between ailerons and fuselage.

FUSELAGE.—Monocoque structure with vertical frames, longitudinal stringers and stressed Alclad skin.

TAIL UNIT.—Cantilever monoplane type. Alclad structure with metal skin over fixed surfaces and fabric covering to rudder and elevators. Controllable trim-tab in starboard elevator and adjustable balance tab in rudder.

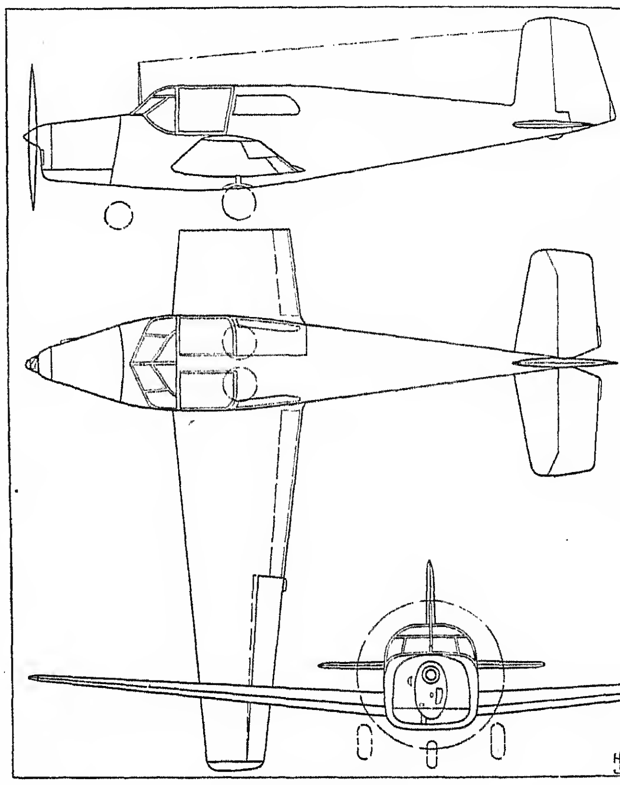
LANDING GEAR.—Retractable tricycle type. Main wheels, carried on oleo-spring shock-absorber legs, retract inwards into fuselage, and nose-wheel backwards into fuselage. Mechanical operation. Hydraulically-operated wheel-brakes controlled by toe-pedals.

POWER PLANT.—One 145 b.h.p. D.H. Gipsy Major 10 four-cylinder in-line inverted air-cooled engine driving two-blade airscrew. Fuel capacity 26 Imperial gallons (118 litres) with 6 Imperial gallons (27 litres) reserve.

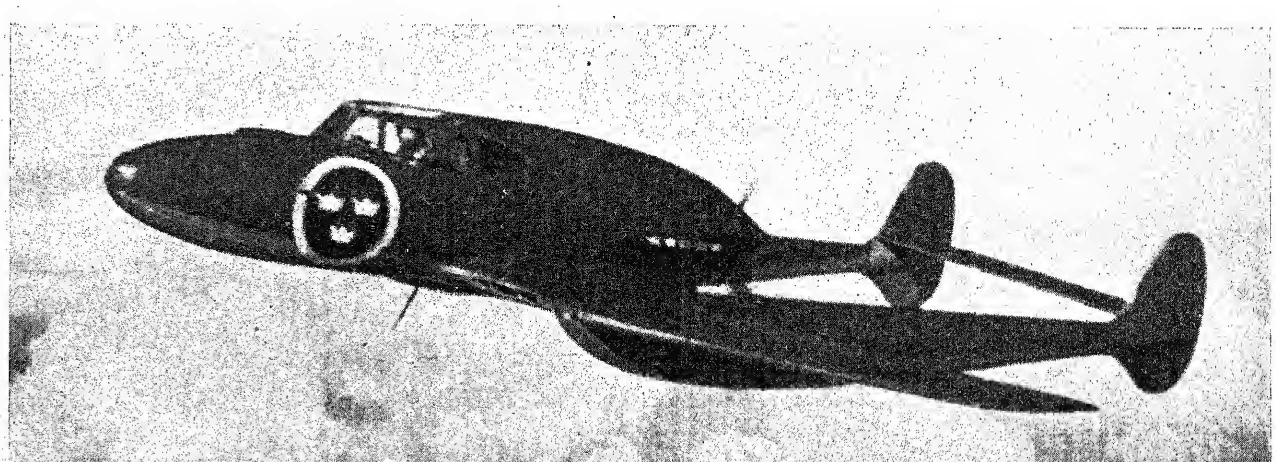
ACCOMMODATION.—Enclosed cabin seating three, pilot (on port) and one passenger side-by-side in front with dual controls, and second passenger behind and on starboard side, with luggage compartment behind pilot. Two passenger seats may be replaced by stretcher or freight. Three sliding panels for access, which can be jettisoned in emergency. Cabin interior width 4 ft. 0 in. (1.22 m.).

DIMENSIONS.—Span 34 ft. 9 in. (10.60 m.), Length 25 ft. 7 in. (7.8 m.), Height 7 ft. 3 in. (2.20 m.).

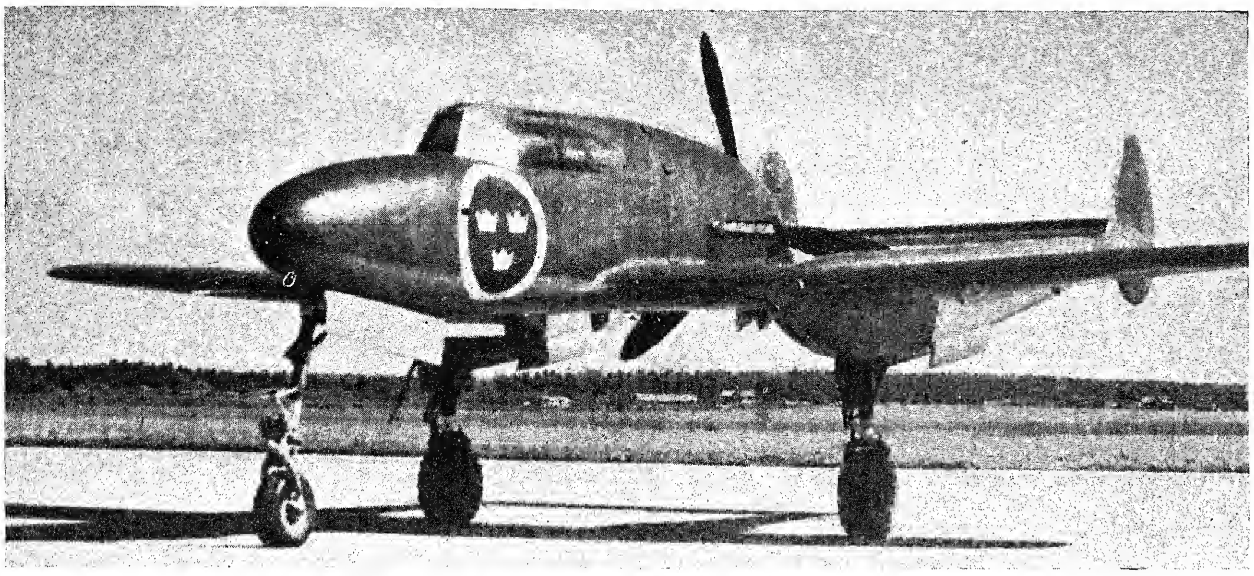
WEIGHTS AND LOADINGS.—Weight empty 1,278-1,344 lbs. (580-610 kg.) according to equipment, Disposable load 849-915 lbs. (385-415 kg.), Weight loaded 2,195 lbs. (995 kg.), Maximum overload 2,369 lbs. (1,074 kg.), Wing loading (at normal loaded weight) 15 lbs./sq. ft. (73.2 kg./sq. m.), Power loading 15.66 lbs./h.p. (7.1 kg./h.p.).



The Saab-91 Safir.



The Saab-21A Single-seat Fighter Monoplane (Swedish-built DB 605B engine).



The Saab-21A Single-seat Fighter Monoplane (Swedish-built DB 605B engine).

PERFORMANCE.—Maximum speed 158 m.p.h. (255 km.h.), Cruising speed 140 m.p.h. (225 km.h.), Stalling speed 50 m.p.h. (80 km.h.), Rate of climb at sea level 830 ft./min. (253 m./min.), Maximum range 652 miles (1,050 km.), Take-off run from grass 590 ft. (180 m.), Take-off distance to 50 ft. (15.24 m.) 1,115 ft. (340 m.), Landing run 505 ft. (154 m.).

THE SAAB-21A.

Swedish Air Force designation : J 21 A.

TYPE.—Single-seat Fighter.

WINGS.—Cantilever mid-wing monoplane. All-metal flush-riveted stressed-skin construction. Surfaces covered with a smooth putty layer to reduce drag. Wing area 238.87 sq. ft. (22.2 sq. m.). Trimming-tab in right aileron.

FUSELAGE.—Central nacelle enclosing cockpit and engine, and two tail-booms terminating in vertical fins. Flush-riveted all-metal construction. Similar surface finish as on wings.

TAIL UNIT.—Tailplane mounted between extremities of tail booms. All-metal structure with flush-riveted metal-covered fixed surfaces and fabric-covered movable surfaces. Trimming-tabs in elevator and right rudder.

LANDING GEAR.—Retractable tricycle type. All wheels raised backwards, the nose wheel into the central nacelle and the main wheels into the tail booms. Apertures closed by hinged panels when wheels retracted.

POWER PLANT.—One SFA (Svenska Flygmoter A.B.) licence-built DB 605B twelve-cylinder inverted Vee liquid-cooled engine rated at 1,475 h.p. for take-off, mounted in rear end of central nacelle and driving a VDM three-blade constant-speed full-feathering propeller. Coolant and oil radiators located in wings between the central nacelle and tail booms with the cooling air entering through ducts in the leading-edge of the wings.

ACCOMMODATION.—Pilot's cockpit in central nacelle above leading-edge of wing with unobstructed forward and side views. The sides of the cockpit canopy are bulged to improve downward and backward views. Pilot's seat mounted on a power-driven catapult to be thrown clear of the propeller disc after release of canopy for emergency exit.

ARMAMENT.—One 20 m/m. cannon and two 13 m/m. machine-guns in the nose of the central nacelle, and two 13 m/m. wing guns, one in each outer wing.

DIMENSIONS.—Span 38 ft. 1 in. (11.60 m.), Length 34 ft. 3 in. (10.45 m.), Height (one propeller blade vertical) 13 ft. 0 in. (3.97 m.).

WEIGHTS AND LOADINGS.—Weight empty 7,165 lbs. (3,250 kg.), Weight loaded 9,149 lbs. (4,150 kg.), Wing loading (fully loaded) 38.3 lbs./sq. ft. (187 kg./sq. m.), Power loading (take-off power) 6.21 lbs./h.p. (2.82 kg./h.p.).

PERFORMANCE.—Maximum speed 398 m.p.h. (640 km.h.), Cruising speed 323 m.p.h. (520 km.h.), Landing speed 90 m.p.h. (145 km.h.).

THE SAAB-18.

Swedish Air Force designations : B 18 and S 18.

The Saab-18 appeared with two types of power plant—the 18A with two 1,050/1,200 h.p. Swedish-built Pratt & Whitney R-1830-S1C3-G radial engines and the 18B with Swedish-built Daimler-Benz DB 605B engines. Production of the 18A has now ceased and the following specification applies to the 18B.

TYPE.—Twin-engined Light Horizontal and Dive-Bomber (B18) or Long-range Reconnaissance (S18) monoplane.

WINGS.—Cantilever mid-wing monoplane. Wings have constant taper from fuselage to tips with all of taper on trailing-edge. All-metal structure, centre-section with three, outer sections with two spars. Wing area 471.28 sq. ft. (43.8 sq. m.). Entire trailing-edge hinged, inner portions acting as camber-changing flaps and outer sections as ailerons. Slotted type dive-brakes hinged under wings outboard of engine nacelles. These brakes lie flush with the under surface of the wings when retracted.

FUSELAGE.—Oval section all-metal monocoque structure stepped up beneath the leading-edge of the wings to provide a ventral rear-firing gun position.

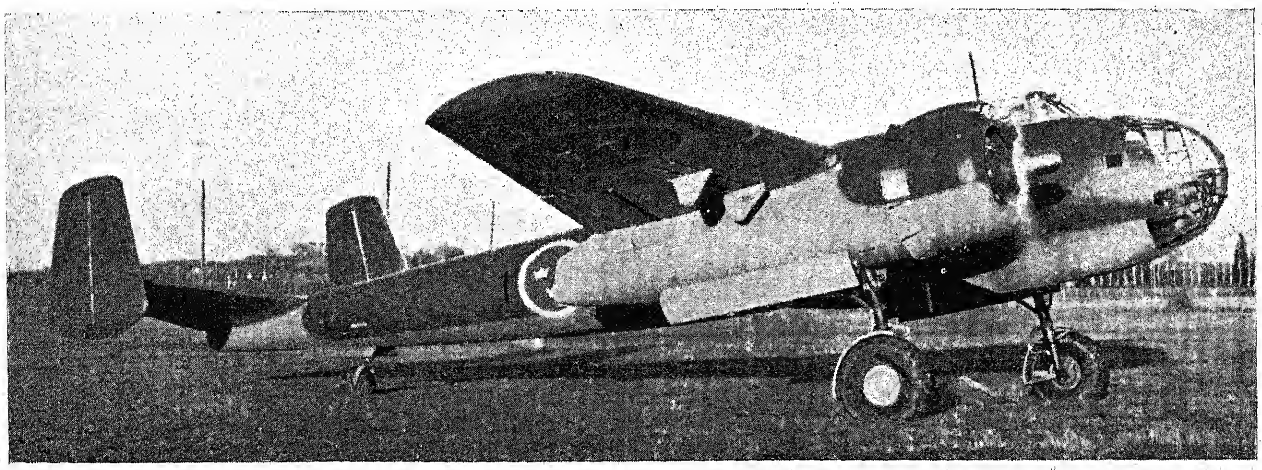
TAIL UNIT.—Cantilever monoplane type with twin fins and rudders. Tailplane has 8° dihedral and vertical surfaces at the extremities are toed-in. All-metal structure with metal-covered fixed surfaces and fabric-covered elevators and rudders. Movable surfaces have trimming-tabs.

LANDING GEAR.—Retractable type. Single cantilever shock-absorber legs retract backwards into tail of engine nacelles. Retractable tail-wheel.

POWER PLANT.—Two Swedish-built Daimler-Benz DB-605B twelve-cylinder inverted-vee liquid-cooled engines developing 1,475 h.p. for take-off and driving VDM-SFA full-feathering airscrews.

ACCOMMODATION.—Bomb-aimer's position in glazed nose of the fuselage. Pilot and radio-operator/rear-gunner in tandem under a continuous transparent canopy offset to the port side of the centre-line.

ARMAMENT.—One fixed forward-firing gun in the starboard side of the fuselage and upper and lower flexible gun positions at the after end of the crew accommodation. Internal bomb stowage in fuselage and beneath wings.



The Saab-18A Three-seat Light Bomber (two Swedish-built Pratt & Whitney engines).

SAAB—*continued.*

The Saab-17B Three-seat Reconnaissance Seaplane (Swedish-built Pegasus engine).

Dimensions.—Span 55 ft. 9 in. (17 m.), Length 43 ft. 5 in. (13.23 m.), Height 14 ft. 3 in. (4.35 m.).

Weights and Loadings.—Weight empty 13,448 lbs. (6,100 kg.), Weight loaded 19,400 lbs. (8,800 kg.), Wing loading (fully loaded) 41.16 lbs./sq. ft. (201 kg./sq. m.), Power loading (take-off power) (6.59 lbs./h.p. (2.99 kg./h.p.).

Performance.—Maximum speed 354 m.p.h. (570 km.h.), Cruising speed 298 m.p.h. (480 km.h.), Landing speed 87 m.p.h. (140 km.h.).

THE SAAB-17.

Swedish Air Force designations: B 17 or S 17.

Type.—Two-seat Dive-Bomber (B17) or Reconnaissance (S17) monoplane.

Wings.—Cantilever mid-wing monoplane. Rectangular centre-section with tapering outer sections. All-metal two-spar structure with flush-riveted smooth metal skin. Centre-section spars pass through the fuselage one in front and one behind the pilot. Wing area 307 sq. ft. (28.5 sq. m.). Split trailing-edges flaps. Frise-type ailerons with trimming-tabs.

Fuselage.—Oval section metal monocoque with flush-riveted smooth metal skin.

Tail Unit.—Cantilever monoplane type. Fin built integral with the fuselage. Metal structure with metal-covered fixed surfaces and fabric-covered control surfaces. Trimming-tabs in right elevator and rudder.

Landing Gear.—Retractable type. Wheels are raised backwards and when in raised position each landing gear unit is completely enclosed forward of the wheel by a fairing attached to the landing gear leg and aft of the wheel by a fixed fairing under the trailing-edge of the centre-section. Oleo shock-absorbers. Low-pressure wheels and brakes. Retractable ski landing-gear may be fitted. Tail-wheel or tail-skid is also retractable. Retractable landing-gear may be replaced by a twin-float installation.

Power Plant.—One Swedish-built Pratt & Whitney R-1830-S1C3G fourteen-cylinder radial air-cooled engine rated at 1,065 h.p. for take-off and driving a Hamilton-SFA controllable-pitch airscrew (Saab-17A), or Swedish-built Bristol Pegasus 24 nine-cylinder radial air-cooled engine rated at 980 h.p. for take-off and driving a Hamilton-SFA controllable-pitch airscrew (Saab-17B) or Piaggio P. XI *bis* R.C.40 fourteen-cylinder radial air-cooled engine rated at 1,000 h.p. for take-off and driving a Piaggio P.1001 controllable-pitch airscrew (Saab-17C). NACA-type cowling with trailing-edge gills.

Accommodation.—Crew accommodation under continuous canopy with hinged and sliding sections over seats and gun positions.

Armament.—Bomb-load carried in internal bomb-bay, under fuselage and under wings. Heavy bombs carried under fuselage on special racks which swing down to enable them to be dropped clear of the airscrew in a dive. No dive-brakes fitted but landing-gear may be lowered in a dive to increase drag, the wheel landing-gear fairings being specially designed for this purpose. Ski landing-gear has dive-brake plates attached to the legs.

Dimensions.—No data available.

Weights and Loadings (17A).—Weight loaded 8,356 lbs. (3,790 kg.), Wing loading 26.80 lbs./sq. ft. (133 kg./sq. m.), Power loading (take-off power) 7.82 lbs./h.p. (3.56 kg./h.p.).

Weights and Loadings (17B Landplane).—Weight loaded 7,947 lbs. (3,605 kg.), Wing loading 25.57 lbs./sq. ft. (127 kg./sq. m.), Power loading (take-off power) 8.13 lbs./h.p. (3.68 kg./h.p.).

Weights and Loadings (17B Seaplane).—Weight loaded 8,433 lbs. (3,825 kg.), Wing loading 27 lbs./sq. ft. (134 kg./sq. m.), Power loading (take-off power) 8.56 lbs./h.p. (3.90 kg./h.p.).

Weights and Loadings (17C).—Weight loaded 8,532 lbs. (3,870 kg.), Wing loading 27.42 lbs./sq. ft. (136 kg./sq. m.), Power loading (take-off power) 8.53 lbs./h.p. (3.87 kg./h.p.).

Performance (17A).—Maximum speed 270 m.p.h. (435 km.h.), Cruising speed 242 m.p.h. (390 km.h.), Landing speed 78 m.p.h. (125 km.h.).

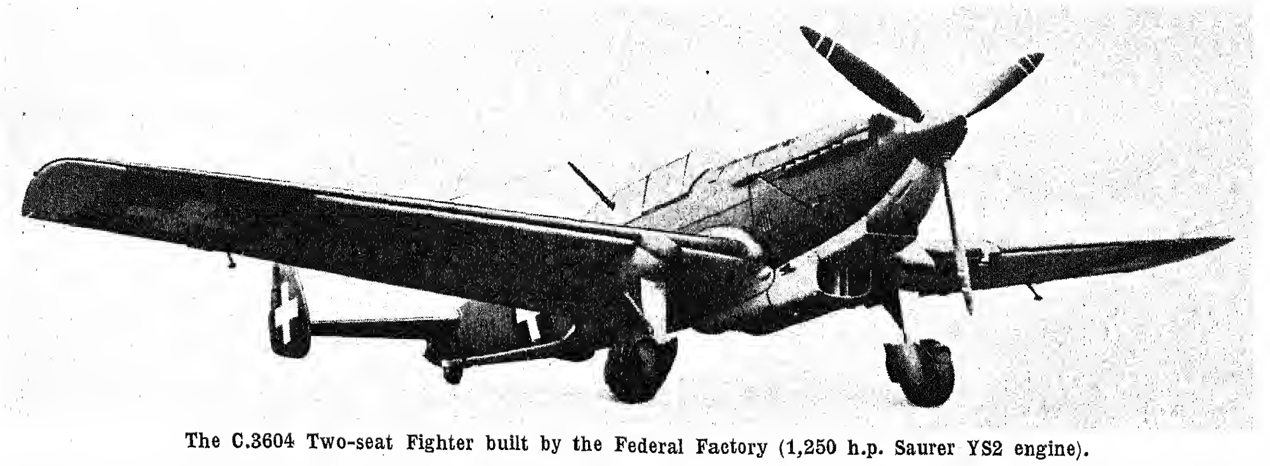
Performance (17B Landplane).—Maximum speed 245 m.p.h. (395 km.h.), Cruising speed 233 m.p.h. (375 km.h.), Landing speed 78 m.p.h. (125 km.h.).

Performance (17B Seaplane).—Maximum speed 214 m.p.h. (345 km.h.), Cruising speed 208 m.p.h. (335 km.h.), Landing speed 78 m.p.h. (125 km.h.).

Performance (17C).—Maximum speed 270 m.p.h. (435 km.h.), Cruising speed 230 m.p.h. (370 km.h.), Landing speed 78 m.p.h. (125 km.h.).

SWITZERLAND

THE FEDERAL AIRCRAFT FACTORY.



The C.3604 Two-seat Fighter built by the Federal Factory (1,250 h.p. Saurer YS2 engine).

FEDERAL AIRCRAFT FACTORY (EIDG. FLUGZEUGWERK EMMEN—FABRIQUE FÉDÉRALE D'AVIONS EMMEN).

Head Office and Works: Emmen, Lucerne.

Director: M. Buri.

This official Government establishment manufactures aircraft for the Swiss Army Air Corps. Its most recent original productions are the C. 3603 and C. 3604, both of which are illustrated and described herewith.

THE C.3603.

Type.—Single-engined Fighter, Short-range Reconnaissance and Bomber monoplane.

Wings.—Low-wing cantilever monoplane. Wing panels taper from roots to tips. All-metal structure with flush-riveted smooth stressed-skin. Trailing-edge flaps between ailerons and fuselage. Wing area 28.7 sq. m. (309.9 sq. ft.).

Fuselage.—Oval section all-metal structure.

Tail Unit.—Cantilever monoplane type with twin fins and rudders. All-metal framework with metal-covered tailplane and fins and fabric-covered single-piece elevator and rudders.

Landing Gear.—Retractable type. Each unit hinged in a shallow fairing under the wings, the shock-absorber legs being retracted backwards and turned through 90° so that the wheels lie flush with the underside of the wings while the legs are enclosed in the fixed fairing beforementioned. Non-retractable tail-wheel.

Power Plant.—One 1,000 h.p. Hispano-Suiza 12Y twelve-cylinder Vee liquid-cooled engine driving a three-blade Escher-Wyss constant-speed airscrew with hollow shaft for a 20 m/m. cannon mounted in the Vee of the engine cylinders.

Accommodation.—Tandem cockpits under a continuous transparent canopy with a sliding section over the pilot and a tip-up section over the rear gunner's cockpit.

Armament.—One 20 m/m. cannon firing through the airscrew shaft, two machine-guns in the wings firing outside the airscrew disc and two machine-guns on a flexible mounting in the rear cockpit. All arms are original products of the Swiss Federal Arms Factory, Berne.

Dimensions.—Span 13.74 m. (45 ft. 1½ in.), Length 10.23 m. (36 ft. 9½ in.), Height (tail down and over airscrew with one blade vertical) 4.07 m. (13 ft. 1 in.).

Weights and Loadings.—Weight empty 2,272 kg. (5,009 lbs.), Useful load and standard equipment 1,185 kg. (2,391 lbs.), Weight loaded (Fighter) 3,450 kg. (7,600 lbs.), Wing loading 120 kg./sq. m. (24.6 lbs./sq. ft.), Power loading 3.4 kg./h.p. (7.5 lbs./h.p.).

Performance.—No data available.

THE C.3604.

The C. 3604 is a development of the type C. 3603 which is equipped as a fighter.

Type.—Single-engined Fighter.

Wings, Fuselage, Tail Unit and Landing Gear.—As C.3603.

Power Plant.—One 1,250 h.p. Saurer YS2 twelve-cylinder Vee liquid-cooled engine with direct injection and driving a four-blade Escher-Wyss constant-speed and reversible-pitch airscrew with hollow shaft for a 20 m/m. cannon mounted in the engine Vee.

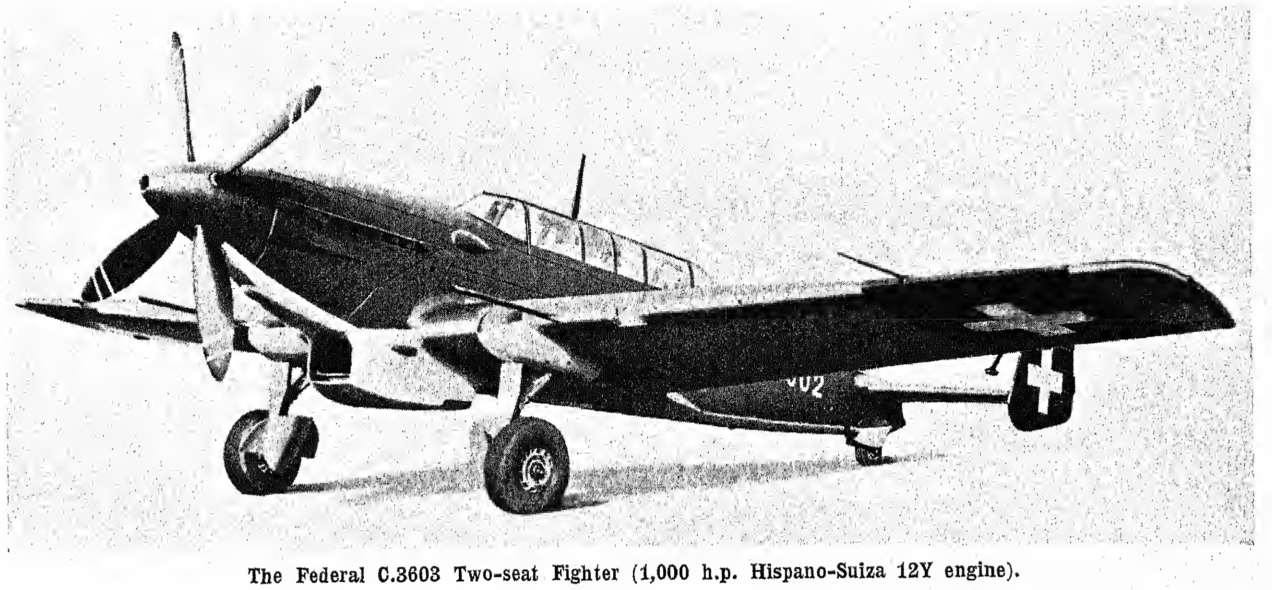
Accommodation.—As C.3603.

Armament.—One 20 m/m. Hispano engine cannon firing through the airscrew shaft, two 20 m/m. Hispano cannon and two machine-guns (Arms Factory, Berne) in the wings and firing outside the airscrew disc. Two machine-guns on flexible Plexiglas-covered mounting (Arms Factory, Berne) in rear cockpit.

Dimensions.—As C.3603.

Weights and Loadings.—Weight empty 2,840 kg. (6,260 lbs.), Standard equipment and useful load 1,460 kg. (3,220 lbs.), Weight loaded (Fighter) 4,300 kg. (9,480 lbs.), Wing loading 150 kg./sq. m. (30.7 lbs./sq. ft.), Power loading 3.4 kg./h.p. (7.5 lbs./h.p.).

Performance.—No data available.



The Federal C.3603 Two-seat Fighter (1,000 h.p. Hispano-Suiza 12Y engine).

DORNIER.

DORNIER-WERKE A.G.

Head Office: Zürich.

Works, Aerodrome and Seaplane Station: Altenrhein

Dornier-Werke A.G. was a branch of the German Dornier company, and was originally formed at the time when the building of military aircraft was forbidden in Germany by the Treaty of Versailles. A large number of Dornier aeroplanes of various types were built for experimental purposes and for export by the Swiss company. It also built the Bücker Jungmann training biplane under licence for the Swiss Government.

FARNER.

FARNER-WERKE A.G.

Head Office and Works : Grenchen (Soleure).

This concern was originally engaged in aero-service, re-building, overhauling and repairs, &c. In 1934 it produced a small two-seat light biplane which was exhibited for the first time at the International Aero Show held at Geneva in that year.

In 1935 it produced, to the designs of M. Weber, a four-seat cabin monoplane known as the WF.21/C4. This model was illustrated and described in the 1936 edition of this Annual.

The latest production of the company is the WF.12, the prototype of which was completed in 1943. This is a two-seat light cabin monoplane with the 90 h.p. Cirrus Minor engine installed aft of the cabin and driving the tractor airscrew through shafts over the top of the cabin. A non-retracting tricycle landing-gear is provided. The cabin seats two side-by-side with dual controls.

The structure comprises a steel-tube fuselage with metal and fabric covering and a single-spar wooden wing with plywood and fabric covering.

Dimensions.—Span 11 m. (36 ft.), Length 7.45 m. (24 ft. 5 in.), Height 2.6 m. (8 ft. 6 in.), Wing area 16 sq. m. (172 sq. ft.).

Weights and Loadings.—Weight empty 560 kg. (1,232 lbs.), Weight loaded 800 kg. (1,760 lbs.), Wing loading 50 kg./sq. m. (10.25 lbs./sq. m.), Power loading 8.9 kg./h.p. (19.58 lbs./h.p.).

Performance.—Maximum speed 175 km.h. (108.6 m.p.h.), Landing speed with flaps 75 km.h. (36.7 m.p.h.).

PILATUS.

PILATUS FLUGZEUGWERKE A.G.

Head Office and Works : Stans, near Lucerne.

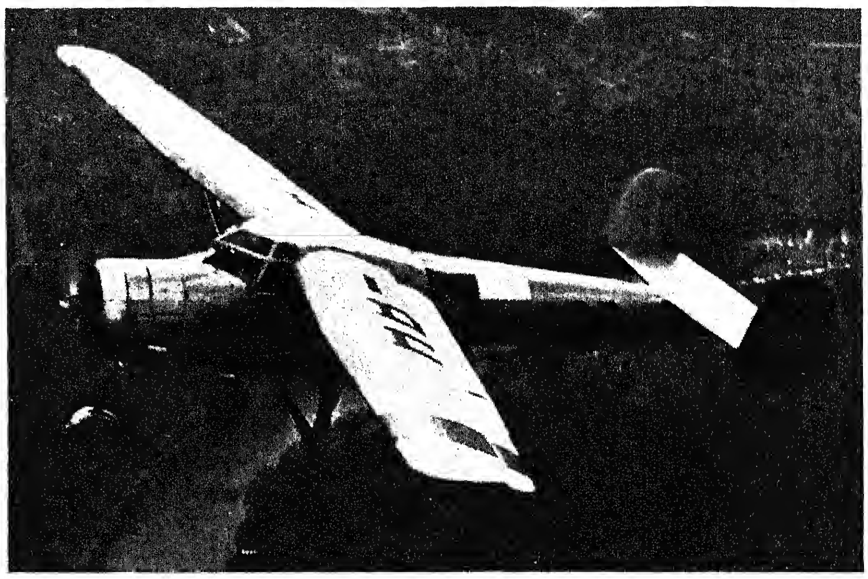
Managing Director : H. F. Alioth.

Chief Engineer : Dipl. Ing. H. Fierz.

Pilatus Flugzeugwerke A.G. was formed in December, 1939, with a capital of two million Swiss francs and it began work in September, 1941. A founder's syndicate was formed in 1938 under the leadership of M. E. Bührle, the Swiss industrialist and owner of the Oerlikon Company, of which the Pilatus Company is now a subsidiary.

The Chief Engineer of the Pilatus Flugzeugwerke was formerly with the firm known as Alfred Comte Schweizerische Flugzeugfabrik, which operated a flying school at Zürich (Dubendorf) for several years and also built a number of aircraft of original design in its workshops. When this Company abandoned aircraft manufacture in 1936, Dipl. Ing. Fierz became Chief of the Technical Services of Swissair.

The first product of the company was the SB-2 Pelican, a four/six-seat cabin monoplane which was developed by the Swiss Aerotechnical Association at the Swiss Institute of Technology at Zürich in collaboration with the Pilatus company. The prototype was flown in 1944 and was later put into service by a Swiss air transport company. The latest Pilatus design is the P-2 two-seat advanced training monoplane.



The Pilatus SB-2 Pelican Four/Six-seat Cabin Monoplane (440 h.p. Pratt & Whitney Wasp-Junior engine).

THE PILATUS SB-2 PELICAN.

Type.—Four/six-seat cabin monoplane.

Wings.—Strut-braced high-wing monoplane. Forwardly-swept wings attached to roots built integrally with the fuselage roof and braced to bottom of fuselage by single struts. Wooden single-spar structure with plywood covering. Automatic slots along entire leading-edge. Hydraulically-operated trailing-edge flaps between ailerons and fuselage. Gross wing area 29 sq. m. (313 sq. ft.).

Fuselage.—Light metal monocoque structure.

Tail Unit.—Wooden cantilever monoplane type with twin fins and rudders mounted as endplates.

Landing Gear.—Fixed tricycle type. Main shock-absorber struts cantilevered from the apices of two rigid pyramids, each of which consists of a vertical strut attached at its upper end to the wing-spar, and a down-sloping Vee, the inner ends of which are attached to the lower sides of the fuselage. Cantilever nose-wheel strut. Steerable nose-wheel interconnected with rudder control. Hydraulic brakes on main wheels.

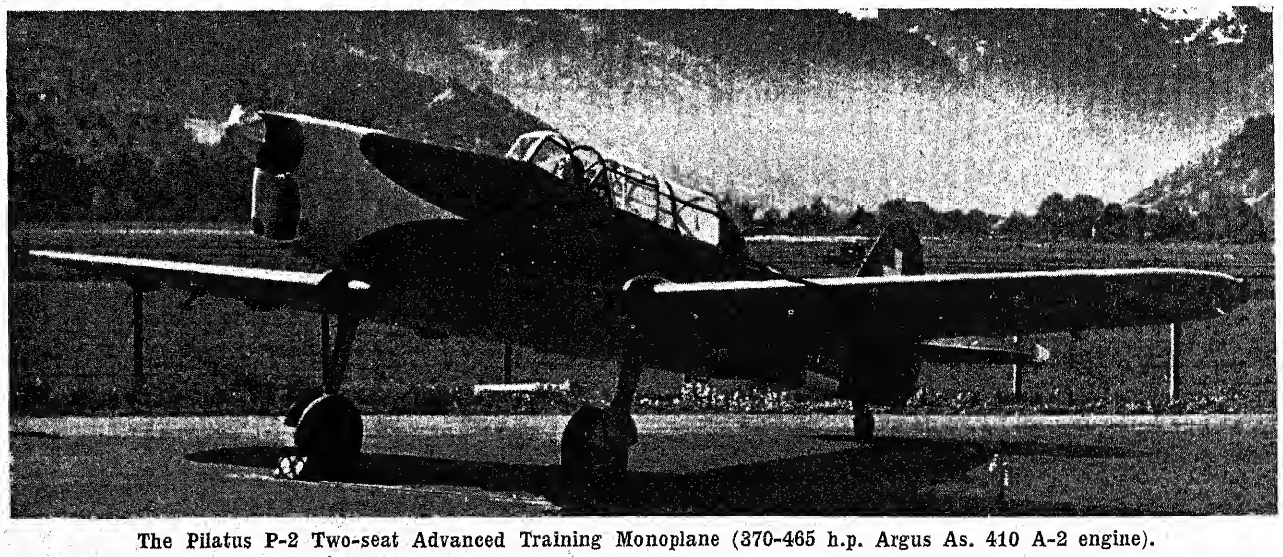
Power Plant.—One 440 h.p. Pratt & Whitney Wasp-Junior TB nine-cylinder radial air-cooled engine driving Hamilton Standard two-blade two-position metal airscrew. Two fuel tanks in wings, each with capacity of 170 litres (37.5 Imp. gallons). Oil capacity 30 litres (6.5 Imp. gallons).

Accommodation.—Enclosed accommodation for crew of two and three or four passengers. Pilot's compartment forward of leading-edge of wings. Sound-proofed and temperature-controlled passenger cabin beneath wings. Mean cabin width 1.37 m. (4 ft. 6 in.), Mean cabin height 1.52 m. (5 ft.), Cabin length 2.18 m. (7 ft. 2 in.). Baggage compartment aft of cabin with access door on starboard side of fuselage. Partition between cabin and baggage compartment may be removed to provide space for bulky freight, which can be loaded through a hatch in the floor. Cabin may also be equipped for ambulance duties.

Equipment.—12-volt electric system with 375-watt generator.

Dimensions.—Span 15.5 m. (50 ft. 10 in.), Length 6.69 m. (31 ft. 10 in.), Height 3.20 m. (10 ft. 6 in.).

Weights and Loadings (As four-seater).—Weight empty 1,596 kg. (3,520 lbs.), Weight loaded 2,095 kg. (4,620 lbs.), Wing loading 71.77 kg./sq. m. (14.7 lbs./sq. ft.), Power loading (take-off) 4.75 kg./h.p. (10.5 lbs./h.p.).



The Pilatus P-2 Two-seat Advanced Training Monoplane (370-465 h.p. Argus As. 410 A-2 engine).

***PILATUS**—continued.*

Weights and Loadings (As six-seater).—Weight empty 1,647 kg. (3,630 lbs.), Weight loaded 2,440 kg. (5,380 lbs.), Wing loading 83.5 kg./sq. m. (17.1 lbs./sq. ft.), Power loading (take-off) 5.52 kg./h.p. (12.2 lbs./h.p.).

Performance (Four-seater with Wasp-Junior engine and Hamilton Standard c.p. airscrew).—Maximum speed 230 km.h. (143 m.p.h.) at sea level, Cruising speed (280 h.p. at 1,950 r.p.m.) 201 km.h. (125 m.p.h.) at sea level, Minimum level speed 76 km.h. (47 m.p.h.), Maximum rate of climb 341 m./min. (1,120 ft./min.), Service ceiling 6,280 m. (20,600 ft.), Maximum cruising range 805 km. (500 miles), Cruising duration 4 hrs., Take-off distance to 15 m. (50 ft.) 306 m. (335 yds.), Landing distance from 15 m. (50 ft.) 220 m. (240 yds).

THE PILATUS P-2.

Type.—Two-seat Advanced Trainer.

Wings.—Cantilever low-wing monoplane. All-metal two-spar structure in one piece, with stressed plywood skin glued and screwed to spars and ribs, and with fabric covering over all. Leading-edge at roots sharply swept back from fuselage. Fabric-covered wooden ailerons aerodynamically and statically-balanced. Wooden ply-covered trailing-edge flaps between ailerons and fuselage. Aspect ratio 7 : 1 Wing area 17 sq. m. (182.9 sq. ft.).

Fuselage.—Light metal structure consisting of four main longerons, two flat side panels and detachable formed top and bottom sections.

Tail Unit.—Cantilever monoplane type. Metal structure with metal-covered fin and tailplane and fabric-covered movable surfaces. Aerodynamically and statically balanced rudder and elevators. Adjustable trim-tab in rudder ; controllable trim-tabs in elevators.

Landing Gear.—Retractable two-wheel type. Each main wheel is carried on single shock-absorber leg attached to front spar and retracts inwards under wings and fuselage ahead of spar and is partly enclosed by fairing plates attached to each leg. Hydraulic operation. Hydraulic brakes on main wheels. Non-retractable tail-wheel in swivelling fork.

Power Plant.—One Argus As 410 A-2 twelve-cylinder inverted vee air-cooled supercharged engine rated at 370 h.p. at 2,000 m. (6,560 ft.) and with 465 h.p. available for take-off at sea level. Electric starter. Argus two-blade constant-speed airscrew with "windmill" type control. Three fuel tanks in wing with capacity of 225 litres (49.5 Imp. gallons).

Accommodation.—Tandem cockpit for pilot (rear) and pupil with long enclosed jettisonable canopy, portions of which slide or hinge for access. Luggage locker aft of rear cockpit. Full night-flying equipment and provision for radio. Rear seat can be fitted with observation or photographic equipment, with pilot in forward cockpit.

Dimensions.—Span 11 m. (36 ft. 1 in.), Length 9.07 m. (29 ft. 9 in.), Height 2.70 m. (8 ft. 10 in.).

Weights and Loadings.—Weight empty 1,380 kg. (3,042 lbs.), Weight loaded (normal) 1,800 kg. (3,968 lbs.), Wing loading 106 kg./sq. m. (21.7 lbs./sq. ft.), Power loading (take-off) 3.87 kg./h.p. (8.52 lbs./h.p.).

Performance.—Maximum speed 340 km.h. (211 m.p.h.) at 2,500 m. (8,200 ft.), Maximum cruising speed 332 km.h. (206 m.p.h.) at 3,300 m. (10,825 ft.), Economic cruising speed 306 km.h. (190 m.p.h.) at 4,500 m. (14,760 ft.), Maximum indicated diving speed 720 km.h. (447 m.p.h.), Landing speed 105 km.h. (65 m.p.h.), Maximum rate of climb (up to 1,750 m.=5,700 ft.) 390 m./min. (1,280 ft./min.), Still-air range at economic cruising speed 865 km. (537 miles) with 225 litres=49.5 Imp. gallons, Take-off run (from grass) 231 m. (253 yds.), Landing run (from grass) 157 m. (172 yds.).

TURKEY

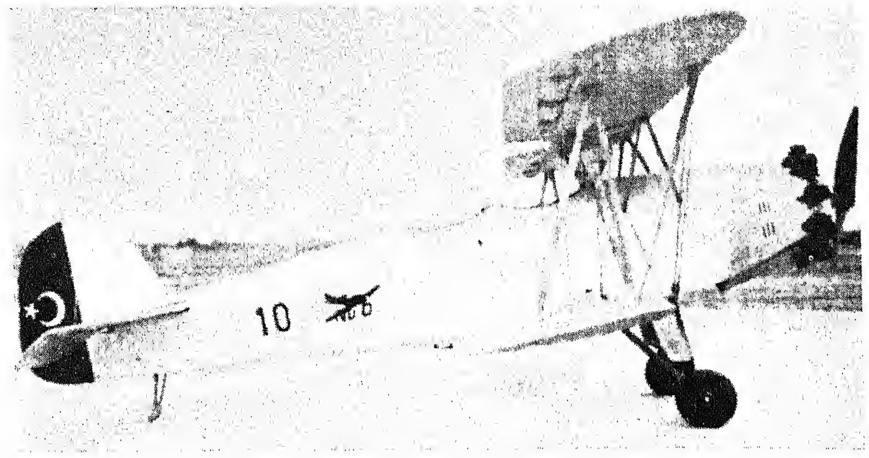
NURI DEMIRAG.

NURI DEMIRAG TAYYARE FABRIKASI (Nuri Demirag Aircraft Works).

Head Office: Besiktas (Istanbul).
Works: Besiktas and Yesilköy (Istanbul).
Aerodrome: Yesilköy (Istanbul).

This factory was established in 1937 by Nuri Demirag. The Nu.D.36 type two-seat training biplane and a Nu.D.38 type, six-seat passenger prototype monoplane described and illustrated in previous editions, have been built from original designs.

The Nu.D.36 biplane has been produced in quantities. In addition, gliders of different types have been constructed under licence.



The Nu.D.36 Two-seat Training Biplane (150 h.p. Walter Gemma engine).

THE Nu.D.36.

Type.—Two-seat training biplane.

Wings.—Unequal-span single-bay staggered biplane. Centre-section attached to fuselage by splayed-out N-struts. One N-type interplane strut on either side of fuselage. Interplane bracing-wires in plane of rear spar of upper wing and front spar of lower wing. Duplicated flying-wires and single landing-wires. Wood structure with fabric covering. Ailerons on upper wings only. Wing area 21.8 sq. m. (234.5 sq. ft.).

Fuselage.—Rectangular structure of riveted steel tubes, covered with fabric.

Tail Unit.—Normal monoplane type with steel-tube frames and fabric covering.

Landing Gear.—Divided type. Comprises two long-stroke shock-absorber struts, the upper ends of which are attached to the upper fuselage longerons with the lower ends hinged to the underside of the fuselage by steel-tube Vees. Wheel-brakes.

Power Plant.—One 150 h.p. Walter Gemma I nine-cylinder radial air-cooled engine on steel-tube mounting. Small fuel tank in centre-section with direct gravity feed. Large fuel tank in fuselage behind fireproof bulkhead feeding the small tank by hand pump.

Accommodation.—Tandem open cockpits with dual controls.

Dimensions.—Span 9.74 m. (31 ft. 11 in.), Height 2.44 m. (8 ft.), Length 7.30 m. (24 ft.),

Weights.—Weight empty 650 kg. (1,430 lbs.), Petrol and oil 160 kg. (352 lbs.), Maximum loaded weight 1,000 kg. (2,204 lbs.).

Performance.—Maximum speed with maximum load 182 km.h. (113 m.p.h.), Landing speed 85 km.h. (52.7 m.p.h.), Climb to 500 m. (1,640 ft.) 2 mins., Climb to 1,000 m. (3,280 ft.) 5.26 mins., Climb to 1,500 m. (4,920 ft.) 10 mins., Service ceiling 3,350 m. (11,000 ft.), Range 500 km. (310.5 miles) or 3.5 hours.

T.H.K.

TURK HAVA KURUMU—UCAK FABRIKASI (Turkish Air League—Aircraft Factory).

Head Office: Ankara.
Works and Aerodrome: Etimesgut, Ankara.

This factory was established by the Turkish Air League in 1941. Its activities include the manufacture of aircraft of its own design and of other types under licence. It also builds gliders of its own design.

THE T.H.K.2.

Type.—Single-seat Aerobatic Trainer.

Wings.—Low-wing cantilever monoplane. Wings of elliptical plan form. Wood single spar structure with a plywood leading-edge forming a D-shaped torsional box member. Hand-operated metal flaps. Ailerons have fabric-covered wood frames. Gross wing area 10.2 sq. m. (109.7 sq. ft.).

Fuselage.—Wooden monocoque structure with plywood skin.

Tail Unit.—Cantilever monoplane type. All-wood framework with plywood-covered tailplane and fin and fabric-covered rudder and elevators. Adjustable trim-tab in elevator controlled from pilot's cockpit.

Landing Gear.—Retractable type. Wheels raised backwards, turning through 90 degrees to lie flat in the wing when raised. Oleo shock-absorbers. Hand retraction. Swivelling tail-wheel fitted with compression rubber shock-absorber.

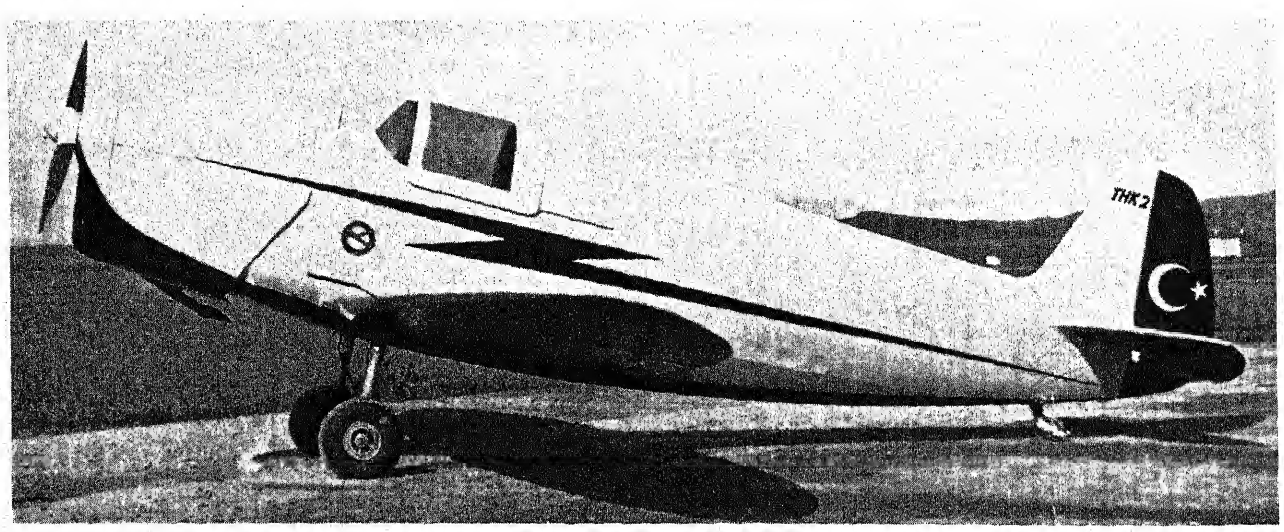
Power Plant.—One 135 h.p. D.H. Gipsy-Major four-cylinder inverted air-cooled engine. Fuel and oil tanks in fuselage.

Accommodation.—Enclosed cockpit with sliding canopy. Conventional controls and instrument equipment.

Dimensions.—Span 8 m. (26 ft. 3 in.), Length 6.98 m. (22 ft. 10½ in.), Height 2.08 m. (6 ft. 10 in.).

Weights.—Weight empty (with equipment) 490 kg. (1,078 lbs.), Pilot 90 kg. (198 lbs.), Fuel and oil 80 kg. (176 lbs.), Weight loaded 660 kg. (1,452 lbs.).

Performance.—Maximum speed at sea level 265 km.h. (164.5 m.p.h.), Cruising speed (60% power) 220 km.h. (136.4 m.p.h.), Stalling speed 80 km.h. (50 m.p.h.), Maximum permissible diving speed 500 km.h. (310.7 m.p.h.), Initial rate of climb 420 m./min. (1,710 ft./min.) Service ceiling 6,000 m. (19,685 ft.), Range in still air 700 km. (435 miles) or 3½ hours.



The T.H.K.2 single-seat Aerobatic Trainer (135 h.p. D.H. Gipsy Major engine).

THE UNITED STATES OF AMERICA

THE DESIGNATION OF AMERICAN SERVICE AIRCRAFT.

The United States military and naval authorities use separate and distinctive schemes to designate aircraft used by their respective air services. These two schemes are described below.

The U.S. Army Air Forces.

Aircraft of the U.S. Army Air Forces are identified by a scheme in which the function of the aircraft is shown by letters. The principal functional letters are :—

A Bombardment (Light)
B Bombardment (Medium and Heavy)
C Transport (Troop or Cargo)
F Reconnaissance (Photographic)
G Autogiro
L Liaison
O Observation
P Fighting
FP Photographic Reconnaissance
R Rotary Wing (Helicopter)
AT Advanced Training
BT Basic Training
PT Primary Training
OA Observation Amphibian
UC Utility Transport (less than 9 seats or less than 1,400 lbs.=635 kg. cargo).
CG Transport Glider
TG Training Glider
GB Glider Bomb
AG Assault Glider
PG Powered Glider
FG Fuel-carrying Glider
BQ Power-driven Controllable Bomb
OQ Aerial Target (non-man-carrying)
PQ Aerial Target (man-carrying)
CQ Target Control

Functional letters are followed by a number to indicate the model, the numbers running consecutively throughout the class or function irrespective of manufacturer.

When the type designation is preceded by the letter X, this indicates that the aircraft is an experimental prototype. Should the preceding letter be a Y, this indicates that the aircraft is the subject of a limited procurement order for service trials. Should a type so designated go into quantity production the X or Y is dropped.

Where combat aircraft are modified for other duties, either because of special requirements or due to obsolescence, the primary designation is qualified by an additional letter indicative of its new duty. For example when the B-26 is stripped of armament and adapted for target-towing duties, the designation is modified by the addition of the T (Training) symbol, thus TB-26. The conversion of fighter aircraft into two-seat transitional trainers produces the TP-39, TP-51, etc. Standard types of fighter aircraft adapted for photographic-reconnaissance duties are no longer distinguished by the separate F symbol. Such aircraft retain their fighter designations with the addition of the F symbol, thus FP-80A, FP-84A, etc.

U.S. Naval Aviation.

U.S. Naval aircraft are designated by a scheme which incorporates letters to define the function and manufacturer of the aircraft, and numbers to indicate the model and modifications of the model.

The latest system introduced in 1946, provides for Fixed-wing piloted aircraft, Pilotless Craft and Rotary-wing aircraft. The functions of fixed-wing piloted aircraft are covered by the following letters :—

A Attack, to destroy enemy surface or ground targets
F Fighter, to destroy enemy aircraft in the air
P Patrol, to search for the enemy
O Observation, to observe and direct ship or shore gunfire
R Transport
U Utility
T Trainer
G Glider

The symbol K signifies pilotless aircraft and this is qualified by further letters to indicate function, thus :—

KS Attack on ship targets
KA Attack on aircraft targets
KG Attack on ground targets
KD Drone
KU Utility

Rotary-wing aircraft, or Helicopters, have the Symbol H with additional qualifying functional letters, thus :—

HH Air/Sea Rescue
HO Observation
HT Training
HR Transport
HU Utility.

The old system of designation was fully outlined in the last edition of "All the World's Aircraft." Aircraft in service or in production at the time of adoption of the new system will retain the old designations by which they were ordered.

The list below details the letters which have been allotted to aircraft manufacturers :—

A Brewster Aeronautical Corporation
B { Beech Aircraft Corporation; Boeing Aircraft Company
C { Curtiss-Wright Corporation, Airplane Division; Cessna Aircraft Company, Inc.; Culver Aircraft Corporation
D { Douglas Aircraft Company, Inc.; Radioplane Company.; McDonnell Aircraft Corporation
E { Bellanca Aircraft Corporation; Gould Aeronautical Division (Pratt, Read & Co.); Piper Aircraft Corporation; Edo Aircraft Corporation
F Grumman Aircraft Engineering Corporation
G Goodyear Aircraft Corporation
H Howard Aircraft Corporation
J North American Aviation, Inc.
K Fleetwings Division, Kaiser Cargo, Inc.
L { Bell Aircraft Corporation; Columbia Aircraft Corporation (now Commonwealth Aircraft, Inc.)
M Glenn L. Martin Company
N Naval Aircraft Factory
O Lockheed Aircraft Corporation
P { Piper Aircraft Corporation (gliders); Piasecki Helicopter Corporation
Q Fairchild Aircraft Corporation
R { Ryan Aeronautical Company; Interstate Aircraft & Engineering Corporation; Aeronca Aircraft Corporation; American Aviation Corporation
S { Sikorsky Aircraft (United Aircraft Corporation); Boeing Aircraft Company, Wichita Division; Schweizer Aircraft Corporation
T { Northrop Aircraft, Inc.; Taylorcraft Aviation Corporation; Timm Aircraft Corporation
U Chance Vought Aircraft (United Aircraft Corporation)
V { Vultee (now Consolidated Vultee); Vega (now Lockheed Aircraft Corporation)
W Waco Aircraft Company
Y Consolidated Vultee Aircraft Corporation

The individual aircraft designations are made up of the functional letter, a model number, the manufacturer's letter and, following a hyphen, a modification or mark number. For example, F7F-3 broken down to its component symbols indicates that the aircraft is a Fighter (F), the seventh of its type (7) built by Grumman (F), and that it is the third (-3) variation or mark of the basic type. The next entirely new Fighter design by Grumman is the F8F.

AERO.

AERO DESIGN AND ENGINEERING CORPORATION.

Head Office: Culver City, California.

President: T. R. Smith.

Chief Engineer: C. W. Gaskell, Jr.

This Company has designed the all-metal Aero Commander twin-engined six/seven-seat light transport monoplane, details of which are given hereafter.

THE AERO COMMANDER L. 3805.

Type.—Twin-engined light transport Monoplane.

Wings.—Cantilever high-wing monoplane consisting of centre-section integral with fuselage and two outer sections. All-metal structure with built-up spars, formed ribs and stressed skin covering. All-metal ailerons on outer wings, and hydraulically-operated flaps between ailerons and fuselage. Wing area (approximate) 236 sq. ft. (21.9 sq. m.).

Fuselage.—All-metal structure with sheet metal covering.

Tail Unit.—Cantilever monoplane type. All-metal structure with metal covering over all surfaces. Trim-tabs in elevators and rudder. Dihedral tailplane. Tailplane span 15 ft. (4.57 m.).

Landing Gear.—Retractable tricycle type. Main wheels carried on oleo shock-absorber legs retract into engine nacelles and nose-wheel retracts into fuselage. Hydraulic operation. Track 12 ft. 4 in. (3.76 m.). Hydraulic brakes on main wheels.

Power Plant.—Two Lycoming O-435A six-cylinder horizontally opposed air-cooled engines each developing 190 h.p. at 2,250 r.p.m. and driving Aeromatic two-blade constant-speed wooden airscrews. Fuel capacity 100 U.S. gallons (379 litres) in bag-type cells in forward portion of centre-section.

Accommodation.—Enclosed cabin of 120 cub. ft. (3.4 cub. m.) capacity with six or seven seats: two side-by-side in front with dual controls, a similar pair behind and a full-width seat at the rear seating two. Seventh seat optional. Main entry door under wing on port side. Door 20 in. (50.8 c/m.) from ground. All equipment can be removed to permit cabin to be used for freight-carrying, and floor may be reinforced. Optional arrangement provides for both passengers and freight. Baggage compartment aft of cabin with capacity of 40 cub. ft. (1.13 cub. m.).

Equipment.—12-volt electric system. G.E. AS1B two-way radio.

Dimensions.—Span 43 ft. 10 in. (13.36 m.), Length 32 ft. (9.75 m.), Height overall 10 ft. 4½ in. (3.16 m.).

Weights and Loadings (Designed).—Weight empty 2,400 lbs. (1,089 kg.), Maximum payload 1,082 lbs. (491 kg.), Weight loaded 4,200 lbs. (1,905 kg.), Wing loading 17.8 lbs./sq. ft. (86.9 kg./sq. m.), Power loading 11 lbs./h.p. (4.98 kg./h.p.).

Performance (Estimated).—Maximum speed 181 m.p.h. (291 km.h.) at sea level. Cruising speed 179 m.p.h. (288 km.h.) at 10,000 ft. (3,050 m.), Landing speed 56 m.p.h. (90 km.h.), Initial rate of climb 1,400 ft./min. (427 m./min.), Service ceiling 22,000 ft. (6,705 m.), One-engine ceiling 8,700 ft. (2,650 m.), Cruising range 700 miles (1,127 km.), Take-off run 317 yds. (290 m.), Landing run 283 yds. (259 m.).

AERO-FLIGHT.

AERO-FLIGHT AIRCRAFT CORPORATION.

Head Office: Buffalo, N.Y.

This Company has produced a two-seat light aircraft powered by an 85 h.p. Continental C85 four-cylinder horizontally-opposed air-cooled engine. It is a low-wing monoplane with two tandem seats enclosed by a bubble-type canopy. No further particulars, apart from the following estimated performance figures were available at the time of writing.

Performance (Estimated).—Maximum speed 175 m.p.h. (282 km.h.) Service ceiling 16,500 ft. (5,030 m.), Range 700 miles (1,126 km.)

AERONCA.

THE AERONCA AIRCRAFT CORPORATION.

Head Office and Works: Middletown Municipal Airport, Middletown, Ohio.

President: John W. Friedlander.

Vice-President: Elmer L. Sutherland.

Vice-President and Director of Purchases: E. H. Wideman.

Sales Manager and Executive Assistant: R. L. Davison.

Director of Sales: A. B. Bennett.

Chief Engineer: Ray Hermes.

Treasurer and Secretary: Albert Helmers.

This Company was incorporated as the Aeronautical Corporation of America in November, 1928, and was the first American company to build and market a truly light aeroplane. The name of the company was changed to its present title in 1941.

During the war the Aeronca Company produced the L-3 light liaison monoplane for the U.S.A.A.F. and the PT-19 and PT-23 primary training monoplanes under Fairchild licence.

For post-war use the company has put into production the 65 h.p. Champion two-seat enclosed monoplane, a development of the Defender trainer (described in past issues of this Annual), and the 65 h.p. Chief, a *de luxe* two-seat side-by-side cabin monoplane. In addition, the Engineering and Research Corporation has granted to Aeronca a licence for the use of the "Erco" "two-control" system. In October, 1946, the company completed the 5,000th Champion to be built since VJ-Day.

Other Aeronca designs under development include the 90 h.p. Arrow, a two-seat enclosed low-wing monoplane, and the Eagle, a four-seat cabin monoplane in the *de Luxe* category.

THE AERONCA ARROW.

The Arrow is a cantilever low-wing cabin monoplane with a retractable two-wheel landing gear and a single fin and rudder. The enclosed cabin seats two side-by-side. The Arrow is of all-metal construction and is powered by a 90 h.p. four-cylinder horizontally-opposed air-cooled engine driving a two-blade variable-pitch airscrew. There is fuel capacity for 25 U.S. gallons (95 litres). Trailing-edge flaps extend between ailerons and fuselage.

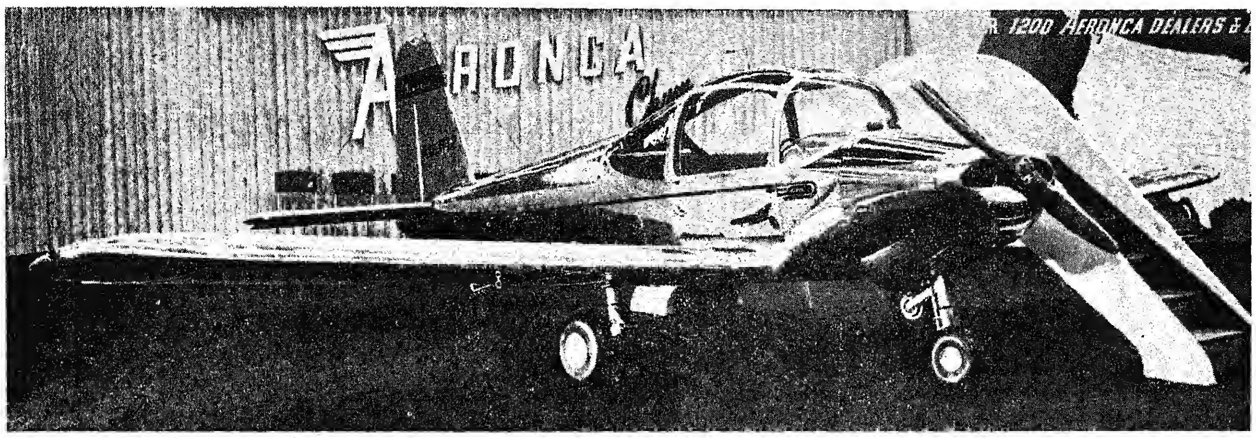
Dimensions.—Span 30 ft. 0 in. (9.14 m.), Wing area 137 sq. ft. (12.72 sq. m.), Aspect ratio 6.57.

Weights and Loadings.—Weight empty 850 lbs. (386 kg.), Disposable load 600 lbs. (272 kg.), Weight loaded 1,450 lbs. (658 kg.), Wing loading 10.6 lbs./sq. ft. (51.76 kg./sq. m.), Power loading 15.9 lbs./h.p. (7.2 kg./h.p.).

Performance.—Maximum speed 135 m.p.h. (244 km.h.), Cruising speed 125 m.p.h. (201 km.h.), Landing speed (with flaps) 48 m.p.h. (77 km.h.), Landing speed (without flaps) 54 m.p.h. (87 km.h.), Rate of climb 550 ft./min. (168 m./min.), Range 500 miles (805 km.).

The Aeronca Arrow Two-seat Cabin Monoplane.

***AERONCA**—continued.*



The Aeronca Chum Two-seat Cabin Monoplane (85 h.p. Continental engine).—(*Martin & Kelman*).

THE AERONCA CHUM.

Type.—Two-seat Cabin monoplane.

Wings.—Cantilever low-wing monoplane. Consisting of short centre-section and two outer wings. All-metal constant-chord two-spar structure with metal-covered leading-edge and fabric covering aft. Metal-framed ailerons with fabric covering. Wing area 140 sq. ft. (13 sq. m.).

Fuselage.—All-metal semi-monocoque structure.

Tail Unit.—Cantilever monoplane type. Metal framework with metal-covered fin and tailplane and fabric covering over movable surfaces. Controllable elevator trim-tab. Tailplane span 10 ft. 2¼ in. (3.1 m.).

Landing Gear.—Fixed tricycle type. Main wheels carried on shock-absorber legs attached to centre-section. Steerable nose-wheel carried in half-fork. Track 7 ft. 1 in. (2.16 m.).

Power Plant.—One Continental C85J four-cylinder horizontally-opposed air-cooled engine rated at 85 h.p. at 2,575 r.p.m. and driving Sensenich two-blade fixed-pitch wooden airscrew. Fuel capacity 22 U.S. gallons (83 litres).

Accommodation.—Enclosed cabin seating two side-by-side with dual controls. Inside width 3 ft. 5½ in. (1.05 m.). Access door of pressed aluminium on each side. Plexiglas windows. Luggage compartment aft of seats has 3 ft. 4 in. × 1 ft. 10 in. (1.015 m. × 0.56 m.) floor, and allowance of 60 lbs. (27 kg.). "Erco" two-control system.

Equipment.—12-volt electric system. Provision for two-way radio.

Dimensions.—Span 28 ft. 8 in. (8.74 m.), Length 20 ft. (6.10 m.). Height overall 6 ft. 5 in. (1.96 m.).

Weights and Loadings.—Weight empty 860 lbs. (390 kg.), Disposable load 540 lbs. (245 kg.), Weight loaded 1,400 lbs. (635 kg.), Wing loading 10 lbs./sq. ft. (48.83 kg./sq. m.), Power loading 16.47 lbs./h.p. (7.46 kg./h.p.).

Performance.—Maximum speed 118 m.p.h. (188.8 km.h.), Cruising speed 108 m.p.h. (172.8 km.h.), Landing speed 49 m.p.h. (79 km.h.), Initial rate of climb 610 ft./min. (186 m./min.), Service ceiling 11,000 ft. (3,355 m.), Cruising range 400 miles (644 km.), Fuel consumption 5.4 U.S. gallons/hr. (20.4 litres/hr.).

THE AERONCA 7AC CHAMPION.

Type.—Two-seat Cabin monoplane.

Wings.—Strut-braced high-wing monoplane. Aerofoil section NACA 4412. Two-spar structure of constant chord built in two sections which are attached directly to top fuselage longerons and braced to lower longerons by V-struts. Solid spruce spars, aluminium-alloy ribs, steel compression ribs and single wire drag-bracing, the whole being fabric-covered. Duralumin ailerons with fabric covering. Wing area 170 sq. ft. (15.79 sq. m.).

Fuselage.—Welded steel-tube structure with four longerons, spruce longitudinal stringers and fabric covering.

Tail Unit.—Wire-braced monoplane type. Welded steel-tube framework with fabric covering attached by metal screws and washers. Fin integral with fuselage. Horn-balanced rudder. Controllable trim-tab in port elevator.

Landing Gear.—Fixed divided type consisting of two interchangeable side vees incorporating oleo shock-absorber struts and two half axles hinged to fuselage centre-line. Dual brakes. Steerable tail-wheel. Wheels replaceable by twin float undercarriage.

Power Plant.—One 65 h.p. Lycoming four-cylinder horizontally-opposed air-cooled engine driving a Sensenich two-blade fixed-pitch wooden airscrew. Fuel capacity 14 U.S. gallons (53 litres).

Accommodation.—Enclosed cabin seating two in tandem with dual controls. Moulded one-piece windscreen.

Dimensions.—Span 35 ft. 0 in. (10.66 m.), Length 21 ft. 6 in. (6.56 m.), Height (tail down) 7 ft. 0 in. (2.13 m.).

Weights and Loadings (Landplane).—Weight empty 710 lbs. (322 kg.), Useful load 510 lbs. (231 kg.), Weight loaded 1,220 lbs. (553 kg.), Wing loading (fully loaded) 7.17 lbs./sq. ft. (35 kg./sq. m.), Power loading (fully loaded) 18.73 lbs./h.p. (8.49 kg./h.p.).

Weights and Loadings (Seaplane).—Weight empty 810 lbs. (367 kg.), Useful load 510 lbs. (231 kg.), weight loaded 1,320 lbs. (598 kg.), Wing loading (fully loaded) 7.76 lbs./sq. ft. (37.89 kg./sq. m.), Power loading (fully loaded) 20.3 lbs./h.p. (9.7 kg./h.p.).

Performance (Landplane).—Maximum speed 100 m.p.h. (161 km.h.), Cruising speed 90 m.p.h. (145 km.h.), Landing speed 38 m.p.h. (61 km.h.), Rate of climb 500 ft./min. (152 m./min.), range at cruising speed 270 miles (434 km.).

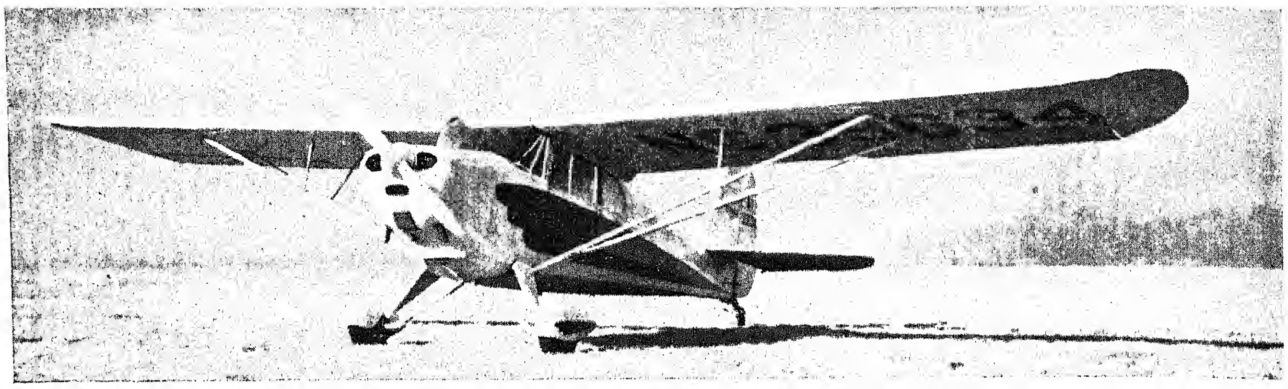
THE AERONCA 11AC CHIEF.

The Aeronca Chief is a variation of the Champion and is generally similar except for an increased fuselage width to accommodate side-by-side seating for two, and a lower cowling line to give better visibility. The wings, tail-unit, landing gear (with the alternative twin-floats) and power-plant are identical to and interchangeable with those of the Champion. The extra fuselage width increases the gross wing area to 175 sq. ft. (16.25 sq. m.). The standard fuel capacity is 15 U.S. gallons (56 litres), which can be supplemented by an 8 U.S. gallon (30 litre) auxiliary tank.

Dimensions.—Span 36 ft. 0 in. (10.97 m.), Length 20 ft. 10 in. (6.35 m.), Height 7 ft. 0 in. (2.13 m.).

The Aeronca Champion Two-seat Cabin Monoplane (65 h.p. Lycoming engine).

AERONCA*—continued.*



The Aeronca Chief Two-seat Cabin Monoplane (65 h.p. Lycoming engine).

WEIGHTS AND LOADINGS (Landplane).—Weight empty 725 lbs. (329 kg.), Useful load 525 lbs. (238 kg.), Weight loaded 1,250 lbs. (567 kg.), Wing loading (fully loaded) 7.14 lbs./sq. ft. (34.86 kg./sq. m.), Power loading (fully loaded) 19.23 lbs./h.p. (8.72 kg./h.p.).

WEIGHTS AND LOADINGS (Seaplane).—Weight empty 825 lbs. (374 kg.), Useful load 525 lbs. (238 kg.), Weight loaded 1,350 lbs. (612 kg.), Power loading (fully loaded) 7.71 lbs./sq.ft. (37.64 kg./sq. m.), Power loading (fully loaded) 20.92 lbs./h.p. (9.49 kg./h.p.).

PERFORMANCE (Landplane).—As Champion, except maximum range (with auxiliary tank) 420 miles (676 km.).

ALL AMERICAN.

ALL AMERICAN AIRCRAFT, INC.

HEAD OFFICE: LONG BEACH 4, CALIFORNIA.

President: Gerald Alder.

Chief Engineer: R. C. Alder.

All American Aircraft, Inc., a company which during the war was engaged in producing specialised aircraft parts for the leading West Coast aircraft manufacturers, has designed and built its first aircraft—the Ensign two-seat all-metal light aeroplane. The prototype first flew towards the end of 1945 from the Lomita Flight Strip, near San Pedro, California.

THE ALL AMERICAN MODEL 10A ENSIGN.

TYPE.—Two-seat Light monoplane.

WINGS.—Cantilever low-wing monoplane of 24ST aluminium-alloy construction. Frise-type self-balancing ailerons of 24ST aluminium construction. Gross wing area 140 sq. ft. (13 sq. m.).

FUSELAGE.—All-metal semi-monocoque structure. Maximum width 3 ft. 8 in. (1.12 m.).

TAIL UNIT.—Cantilever monoplane type of all-metal construction with metal covering. Controllable trim-tab in elevator. Tail-plane span 10 ft. 8 in. (3.25 m.).

LANDING GEAR.—Retractable tricycle type. Main wheels, carried on cantilever oleo shock-absorber struts, retract inwards into fuselage. and full-castering nose-wheel in forked shock-absorber strut retracts backwards into fuselage. Firestone hydraulic spot brakes operated from rudder pedals. Track 8 ft. 4 in. (2.54 m.).

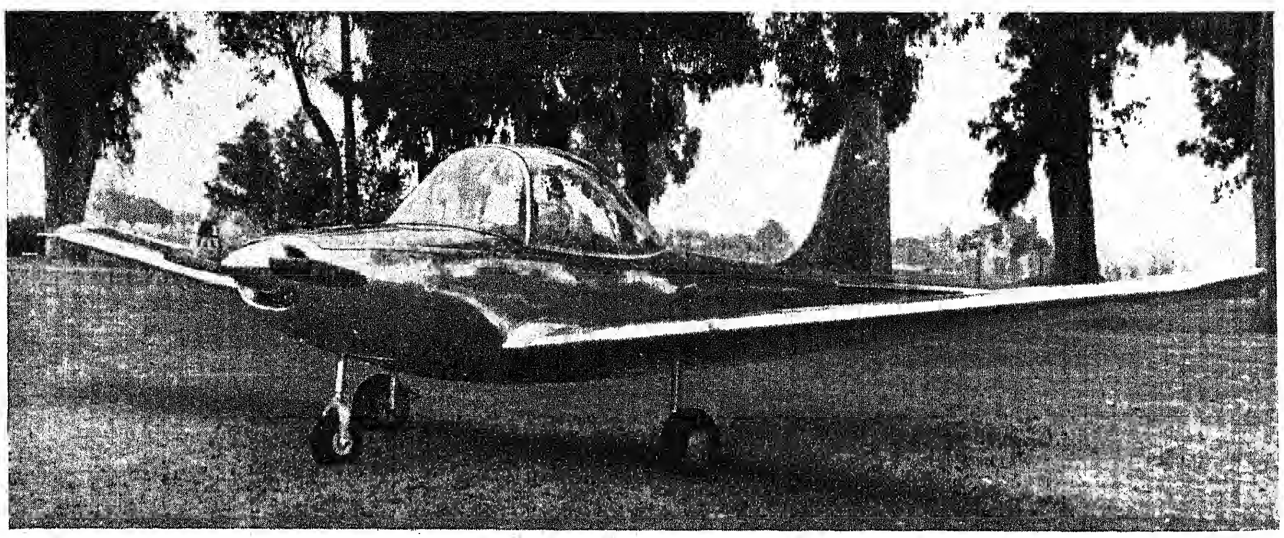
POWER PLANT.—One 85 h.p. Continental C85-12 four-cylinder horizontally-opposed air-cooled engine on steel-tube mounting and driving Sensenich two-blade fixed-pitch wooden airscrew. Alternatively power-unit up to 125 h.p. can be installed, with provision for either constant-speed or variable pitch airscrew. Fuel capacity 25 U.S. gallons (94 litres) in single fuselage tank.

ACCOMMODATION.—Enclosed cockpit with two seats side-by-side Large Plexiglas bubble canopy slides backwards for access. Dual controls optional. Baggage compartment 1 ft. 6 in. long × 3 ft. 6 in. wide × 2 ft. 0 in. deep (.457 × 1.07 × .61 m.) aft of seats.

DIMENSIONS.—Span 33 ft. 0 in. (10.05 m.), Length 22 ft. 0 in. (6.71 m.), Height (over rudder) 8 ft. 6 in. (2.59 m.).

WEIGHTS AND LOADINGS.—Weight empty 900 lbs. (408 kg.), Useful load 550 lbs. (249 kg.), Weight loaded 1,450 lbs. (657 kg.), Wing loading (fully loaded) 10.35 lbs./sq. ft. (50 kg./sq. m.), Power loading 17 lbs./h.p. (7.7 kg./h.p.).

PERFORMANCE (Estimated).—Maximum speed 125 m.p.h. (201 km.h.), Cruising speed 112 m.p.h. (180 km.h.), Landing speed 50 m.p.h. (80 km.h.), Rate of climb 700 ft./min. (213 m./min.), Service ceiling 14,000 ft. (4,265 m.), Range at cruising speed 400 miles (644 km.).



The All American Ensign Two-seat Light Monoplane (85 h.p. Continental engine).

AMERICAN EAGLECRAFT.

AMERICAN EAGLECRAFT COMPANY.

HEAD OFFICE AND WORKS: FORT WORTH, TEXAS.

President: V. A. Robinson.

This company has revived an experimental two-seat open-cockpit high-wing monoplane known as the American Eaglet, the prototype of which was built in 1942. Tests were postponed, but these are now being completed, two further aircraft are being built and the plant is being expanded to undertake commercial production.

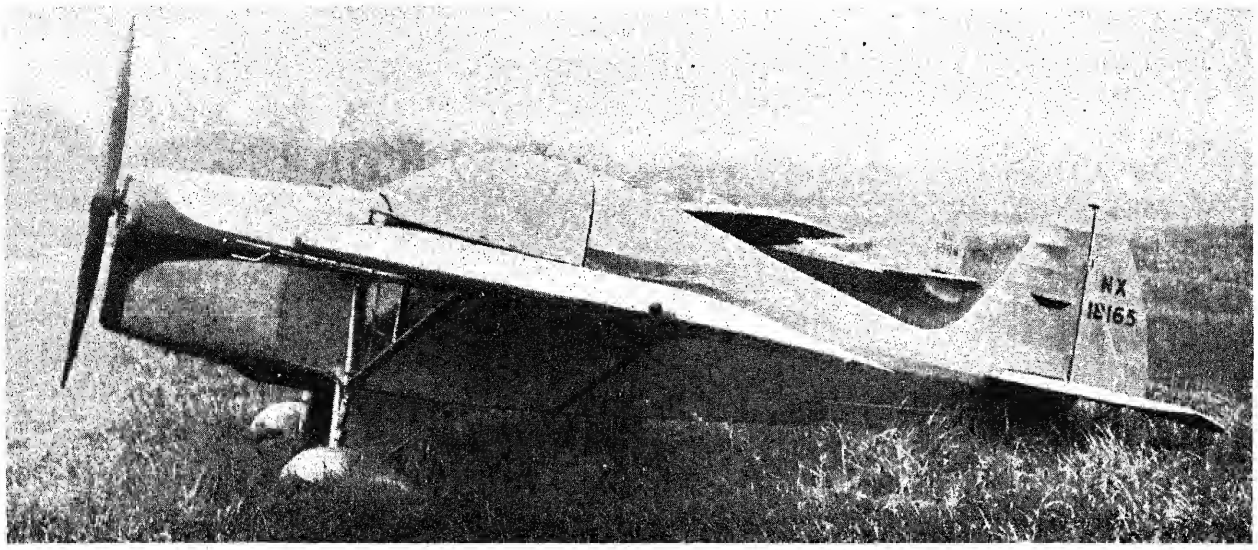
The American Eaglet is a conventional strut-braced high-wing monoplane with divided rubber-sprung landing-gear and a 50 h.p. Continental engine.

DIMENSIONS.—Span 34 ft. 4 in. (10.47 m.), Length 22 ft. 9 in. (6.94 m.), Height 7 ft. 1 in. (2.14 m.), Wing area 164.4 sq. ft. (15.3 sq. m.).

WEIGHTS.—Weight empty 638 lbs. (290 kg.), Weight loaded 1,050 lbs. (478 kg.).

PERFORMANCE.—Maximum speed 92 m.p.h. (147.2 km.h.), Landing speed 28 m.p.h. (45 km.h.), Initial rate of climb 700 ft./min. (213.5 m./min.), Cruising range 225 miles (260 km.), Service ceiling 14,500 ft. (4,420 m.).

BARTLETT.



The Bartlett Zephyr Two-seat Cabin Monoplane (150 h.p. Franklin engine).—(*Boardman C. Reed*).

BARTLETT AIRCRAFT CORPORATION.

Head Office: Rosemead, California.

The Bartlett Aircraft Corpn. has produced the Blue Zephyr two-seat strut-braced monoplane, which has been developed from the Babcock monoplane of the 1930's. A production version of this aircraft, known as the LC-13 A Zephyr 150, is powered by a 150 h.p. Franklin six-cylinder engine.

THE BARTLETT LC 13-A ZEPHYR 150.

Type.—Two-seat Cabin monoplane.

Wings.—Braced mid-wing monoplane. Tapered structure with wooden spars and ribs, metal-covered leading-edge and fabric covering aft. Single strut on each side braces wing to fuselage. Wing area (approximate) 132 sq. ft. (12.25 sq. m.).

Fuselage.—Steel-tube structure with fabric covering.

Tail Unit.—Braced monoplane type. Metal framework with fabric covering over all surfaces. Fin and tailplane wire-braced.

Landing Gear.—Fixed two-wheel type. Main wheels (Goodyear 6.00-6) carried on oleo shock-absorber legs attached to fuselage. Goodyear hydraulic brakes and tyres. Bartlett steerable tail-wheel integral with rudder.

Power Plant.—One Franklin 6A4-150-B3 six-cylinder horizontally-opposed air-cooled engine developing 150 h.p. at 2,600 r.p.m. and driving two-blade constant-speed airscrew. Fuel capacity 50 U.S. gallons (189 litres).

Accommodation.—Enclosed cabin seating two side-by-side. Access door on each side. Baggage compartment aft of seats.

Equipment.—12-volt electric system. General Electric two-way radio.

Dimensions.—Span 30 ft. 9 in. (9.34 m.), Length 21 ft. (6.40 m.), Height (over cabin, tail up) 6 ft. (1.83 m.).

Weights and Loadings.—Weight empty 965 lbs. (438 kg.), Disposable load 685 lbs. (311 kg.), Weight loaded 1,650 lbs. (749 kg.), Wing loading 12.5 lbs./sq. ft. (61 kg./sq. m.), Power loading 11 lbs./h.p. (4.98 kg./h.p.).

Performance.—Maximum speed 150 m.p.h. (241 km.h.), Cruising speed 135 m.p.h. (217 km.h.), Landing speed 42 m.p.h. (68 km.h.), Stalling speed (approximate) 35 m.p.h. (56 km.h.), Initial rate of climb 1,500 ft./min. (457 m./min)., Service ceiling 18,000 ft. (5,485 m.), Cruising range 500 miles (805 km.), Cruising fuel consumption 9.25 U.S. gallons/hr. (35 litres/hr.).

BAUMANN.

BAUMANN AIRCRAFT CORPORATION.

Head Office and Works: Roscoe, California.

President: T. B. Baumann.

Mr. T. B. Baumann, founder of the Baumann Aircraft Corpn. has designed the Brigadier 250 twin-engined pusher monoplane intended for executive duties. The prototype was expected to fly late in 1946. Mr. Baumann was formerly a research and design engineer with the Lockheed Aircraft Corpn. and was later founder and chief engineer of Mercury Aircraft, Inc.

THE BAUMANN BRIGADIER 250.

Type.—Twin-engined five-seat pusher monoplane.

Wings.—Cantilever shoulder-wing monoplane consisting of constant-chord centre-section carrying engines and two tapered outer wings. Metal spars and ribs and sheet metal covering. All-metal ailerons, with manually-operated all-metal split trailing-edge flaps between ailerons and fuselage. Wing area (approximate) 213 sq. ft. (19.79 sq. m.).

Fuselage.—All-metal semi-monocoque structure of oval cross-section.

Tail Unit.—Cantilever monoplane type. Metal framework with metal-covered fin and tailplane and fabric covering to rudder and elevators. Controllable elevator trim-tabs. Tailplane span 13 ft. 2 in. (4.01 m.).

Landing Gear.—Retractable tricycle type. Main wheels each carried on single oleo shock-absorber legs retract outward into wings outboard of engines. Electric operation. Hydraulic brakes and Goodyear 6.50 × 10 tyres. Track 11 ft. 6 in. (3.5 m.). Nose-wheel is steerable and retracts into fuselage. Goodyear 6.00 × 6 tyre.

Power Plant.—Two Continental C125 six-cylinder horizontally-opposed air-cooled engines each developing 125 h.p. at 2,550 r.p.m. mounted within centre-section as pusher units and driving Continental or Aeromatic two-blade propellers. Fuel capacity 60 U.S. gallons (227 litres).

Accommodation.—Enclosed cabin seating pilot (on port) and one passenger side-by-side with dual controls, and full-width seat for three passengers behind. Access door on each side. Baggage compartment of 12 cub. ft. (0.33 cub. m.) capacity aft of rear seats; allowance 270 lbs. (122 kg.).

Dimensions.—Span 41 ft. (12.49 m.), Length 27 ft. 5 in. (8.36 m.), Height (overall) 10 ft. 2 in. (3.10 m.).

Weights and Loadings (Designed).—Weight empty 1,980 lbs. (898 kg.), Disposable load 1,220 lbs. (453 kg.), Payload 750 lbs. (340 kg.), Weight loaded 3,200 lbs. (1,451 kg.), Wing loading 15 lbs./sq. ft. (73.2 kg./sq. m.), Power loading 12.5 lbs./h.p. (5.66 kg./h.p.).

Performance (Estimated).—Maximum speed 170 m.p.h. (274 km.h.), Maximum speed on one-engine 110 m.p.h. (177 km.h.), Cruising speed 150 m.p.h. (241 km.h.), Landing speed 60 m.p.h. (97 km.h.), Stalling speed 55 m.p.h. (88.5 km.h.), Initial rate of climb 1,250 ft./min. (381 m./min.), One-engine rate of climb 350 ft./min. (107 m./min.), Service ceiling 18,000 ft. (5,485 m.), One-engine ceiling 5,000 ft. (1,525 m.), Cruising range 600 miles (966 km.), Fuel consumption 7.5 U.S. gallons/hr. per engine (28 litres/hr. per engine).

BEECHCRAFT.

BEECH AIRCRAFT CORPORATION.

Head Office and Works: East Central Avenue, Wichita, Kansas.

Established: April, 1932.

President: Walter H. Beech.

Vice-President and General Manager: J. P. Gaty.

Vice-President and Chief Engineer: T. A. Wells.

Vice-President in charge of Purchasing: R. K. Beech.

Vice-President and Co-ordinator: Frank E. Hedrick.

Secretary and Treasurer: O. A. Beech.

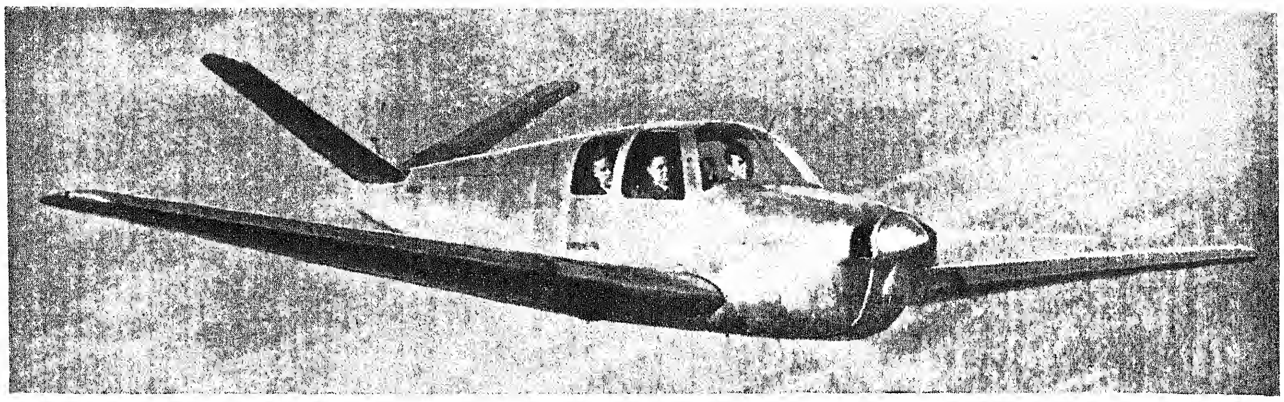
The Beech Aircraft Corporation was formed in 1932 by Mr. Walter H. Beech, one of the pioneers of light commercial airplanes in the United States.

In 1925 he helped to form the Travel Air Manufacturing Company and developed a notable range of commercial and training aeroplanes. In 1929, the Travel Air Company was merged with the Curtiss-Wright group, and Mr. Walter Beech was placed in charge of sales and continued in this capacity until he resigned to form the Beech Aircraft Corporation.

During the war the Corporation delivered 7,364 aeroplanes, 1,635 complete sets of wings for the Douglas A-26 Attack Bomber, and innumerable spare parts for all types. Scheduled deliveries were maintained up to V-J Day, and thereafter Beechcraft was one of the first major aircraft builders to resume commercial production in substantial volume. At the time of the Japanese surrender, the company was still building the UC-45 personnel transport, one of the very few non-tactical aircraft in demand by the U.S. Air Forces after hostilities ended in Europe.

Sixteen weeks after V-J Day, a group of Beechcraft Model D18S twin-engined executive personnel aeroplanes, the post-war civil version of the UC-45 Expediter, was ready for delivery. Beechcraft was the first firm in the United States to receive a

***BEECHCRAFT**—continued.*



The Beechcraft 35 Bonanza Four-seat Cabin Monoplane (165 h.p. Continental E165 engine).

C.A.A. Approved Type Certificate for a new model produced after the war.

In addition to the Model D18S, Beechcraft is producing the following aeroplanes:—the Model D18C, a ten-seat light transport similar in design and dimensions to the D18S, but powered with two 525 h.p. engines and Hydromatic full-feathering airscrews; the Model G17S, a completely re-designed and improved version of the pre-war Beechcraft five-seat cabin biplane, which was also widely used in the war under the name Traveler; the Model 34 feeder-line transport; and the Model 35 Bonanza, a four-seat all-metal low-wing monoplane in the medium-price field.

Production has been discontinued on the following aircraft:—U.S. Army AT-7 (U.S. Navy SNB-2) Navigator; U.S. Army AT-10 Wichita; U.S. Army AT-11 (U.S. Navy SNB-1) Kansan; U.S. Army F-2; U.S. Army C-45 (U.S. Navy JRB) Expediter; U.S. Army UC-43 (U.S. Navy GB) Traveler. All these aircraft have been described in previous issues of this Annual. A description follows of the Beechcraft XA-38 experimental Attack monoplane, details of which were not available for publication in the last edition.

THE BEECHCRAFT MODEL 35 BONANZA.

TYPE.—Four-seat Cabin monoplane.

WINGS.—Cantilever low-wing monoplane. Beech modified NACA 23000 series aerofoil section. All-metal structure with dihedral from roots, and with roots swept-back from fuselage. All-metal ailerons with trim-tab in each. Fowler-type flaps between ailerons and fuselage. Wing area 177.6 sq. ft. (16.49 sq. m.).

FUSELAGE.—Metal structure with flush-riveted metal skin.

TAIL UNIT.—"Butterfly" type consisting of tailplane and elevators set at acute dihedral angle. Elevators act also as rudders. Balanced elevators with controllable trim-tab in each. Tailplane span 10 ft. $5\frac{9}{16}$ in. (3.19 m.).

LANDING GEAR.—Retractable tricycle type. Each main wheel, carried on inner side of Beech air-oil strut, retracts inwards into wing and is enclosed by fairing plates attached to leg and by slightly-bulged hinged doors under wing. Doors close when wheels are in extended position. Track 9 ft. $7\frac{3}{8}$ in. (2.93 m.). Goodyear wheels with single-disc hydraulic brakes and 6.50 × 8 tyres. Full-swivelling Goodyear nose-wheel with anti-shimmy device, carried in half-fork on Beech air-oil strut, retracts backwards into fuselage.

POWER PLANT.—One Continental E165 six-cylinder horizontally-opposed air-cooled engine rated at 165 h.p. at 2,050 r.p.m. at sea level. Beech R-100 two-blade electrically-controlled variable-pitch airscrew, 7 ft. 4 in. (2.23 m.) diameter, with Beech R900-101 pitch-control motor and Beech spinner. Fuel capacity 40 U.S. gallons (151 litres) in two wing tanks. Oil capacity $2\frac{3}{4}$ U.S. gallons (10.4 litres).

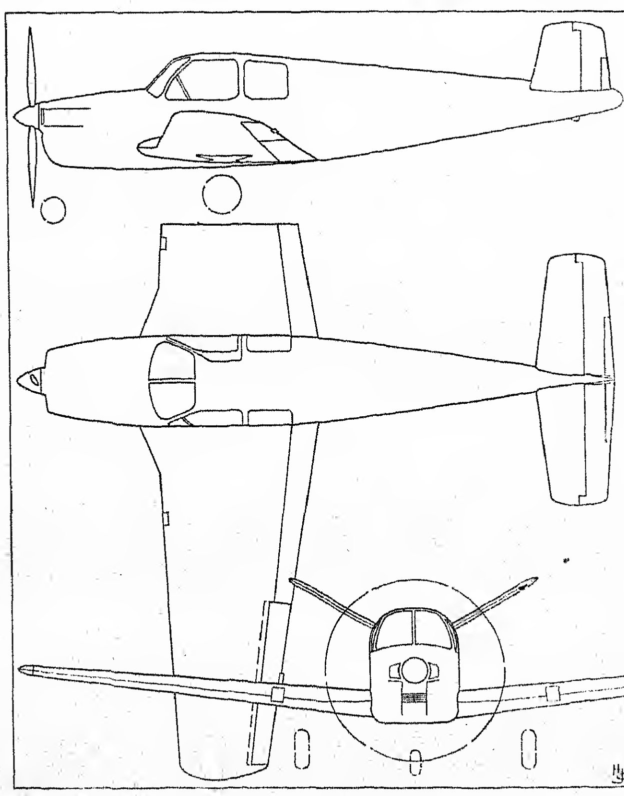
ACCOMMODATION.—Four-seat enclosed cabin. Two separate seats side-by-side in front, with orthodox throw-over dual controls and full-width seat behind. Cabin dimensions 6 ft. 11 in. long × 3 ft. 6 in. wide × 4 ft. 2 in. high (2.11 × 1.07 × 1.27 m.). Access door 3 ft. × 3 ft. 1 in. (0.91 × 0.916 m.) on starboard side. Lucite moulded windscreen and windows. Rear windows open for ground ventilation, and have release pins to permit their use as emergency exits. Cabin structure reinforced for protection in turn-over. Two baggage compartments with total capacity of 16.5 cub. ft. (0.47 cub. m.) and allowance of 120 lbs. (54 kg.) aft of seats. Access door 2 ft. × 1 ft. 10 in. (0.61 × 0.56 m.) on starboard side of fuselage.

EQUIPMENT.—Full radio and navigational equipment fitted as standard. Delco-Remy starter and generator.

DIMENSIONS.—Span 32 ft. 10 in. (10 m.), Length 25 ft. 2 in. (7.67 m.), Height 6 ft. $6\frac{1}{2}$ in. (2 m.).

WEIGHTS AND LOADINGS.—Weight empty (fully equipped) 1,490 lbs. (676 kg.), Useful load 1,060 lbs. (481 kg.), Pay-load with maximum fuel 780 lbs. (354 kg.), Weight loaded 2,550 lbs. (1,157 kg.), Wing loading (fully loaded) 14.35 lbs./sq. ft. (70 kg./sq. m.), Power loading (fully loaded) 15.45 lbs./h.p. (7 kg./h.p.).

PERFORMANCE.—Maximum speed 184 m.p.h. (296 km.h.) at sea level, Recommended cruising speed (115 h.p.) 175 m.p.h. (282 km.h.) at 10,000 ft. (3,050 m.), Stalling speed at sea level (without flaps) 59 m.p.h. (95 km.h.), With flaps at 30 degrees 46 m.p.h. (74 km.h.), Rate of climb at sea level 950 ft./min. (290 m./min.), Service ceiling 18,000 ft. (5,485 m.), Maximum range at 165 m.p.h. (265 km.h.) at 10,000 ft. (3,050 m.) 750 miles (1,207 km.), Take-off run in 10 m.p.h. (16 km.h.) wind at sea level 142 yds. (130 m.), Landing run in 10 m.p.h. (16 km.h.) wind at sea level 105 yds. (96 m.), Fuel consumption 14.5-18.8 miles per U.S. gallon (6.14-7.55 km. per litre).



The Beechcraft Model 35 Bonanza.

THE BEECHCRAFT MODEL 34.

The Model 34 has been designed primarily as a 20-passenger feeder-line transport. It incorporates a "butterfly" tail and a novel power-plant installation consisting of four 375 h.p. Lycoming S-580 eight-cylinder horizontally-opposed super-charged engines buried in the wings in pairs, each pair driving a Hamilton Standard full-feathering tractor airscrew through a special gear-box and automatic clutch. The fuselage and tricycle landing-gear are conventional.

Full information and photographs had not been released for publication when these pages closed for press.

DIMENSIONS.—Span 70 ft. (21.35 m.), Length 51 ft. (15.55 m.), Height 14 ft. 4 in. (4.37 m.).

WEIGHTS AND LOADINGS (Designed).—Maximum payload 4,530 lbs. (2,660 kg.), Weight loaded 15,000 lbs. (6,810 kg.), Wing loading 23.3 lbs./sq. ft. (113.7 kg./sq. m.).

PERFORMANCE (Estimated).—Cruising speed (60% power), 183 m.p.h. (292.8 km.h.) at 5,000 ft. (1,525 m.), Cruising range 600 miles (960 km.).

THE BEECHCRAFT MODEL 28.

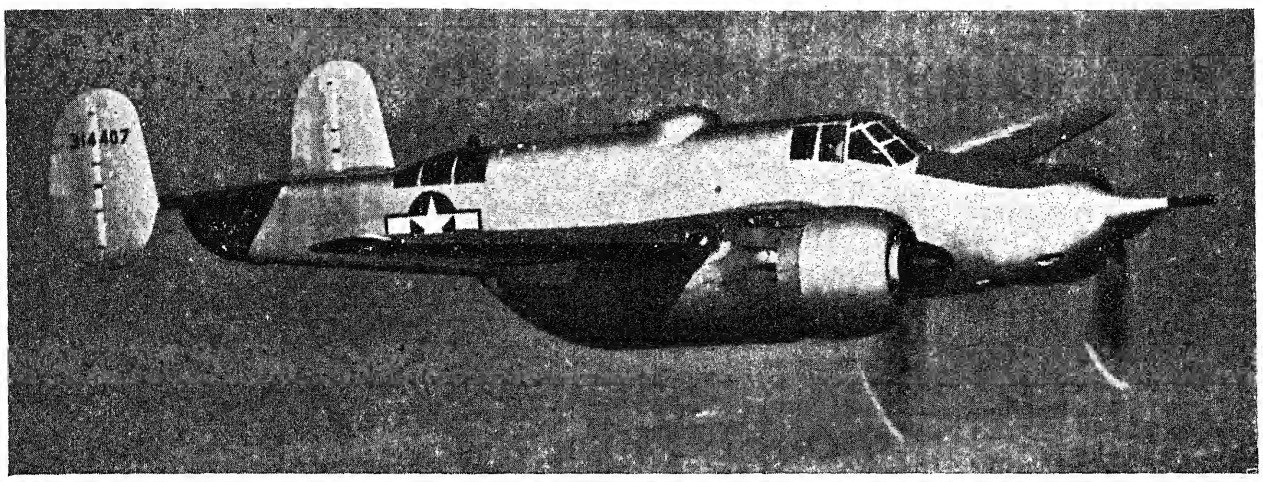
U.S. Army Air Forces designation : XA-38.

The XA-38 was designed and built during the war by the Beech Aircraft Corporation, but never was put into production because completion of the two prototypes was delayed by lack of availability of engines. Engines of the type specified for this aircraft were urgently needed for the Boeing B-29 Superfortress and when engines were eventually available other attack bombers of advanced design were in production.

TYPE.—Twin-engined Attack monoplane.

WINGS.—Cantilever mid-wing monoplane. Aerofoil section derived from NACA 2300 series. Wing of all-metal two-spar construction with stressed skin covering. Spars incorporate heavy cap sections with tension field type webs. Main spar at 25% chord passes through fuselage. Rear spar at 75% chord joined at fuselage. Wing built in six sections: two half-centre-sections joined on fuselage centre-line, two outer panels and detachable semi-circular

***BEECHCRAFT**—continued.*



The Beechcraft XA-38 Twin-engined Attack Monoplane (two 2,300 h.p. Wright R-3350 engines).

tips. Thermal de-icing, with air discharge at trailing-edge. Incidence (root) 4.39 degrees; (tip) 1 degree; Dihedral (at ¼-chord point) 5 degrees. Wing area 625.9 sq. ft. (58.15 sq. m.). All-metal ailerons in outer panels, metal covering. Aerodynamically, dynamically and statically-balanced. Balancing tabs in each aileron; that in port aileron acts also as trim-tab controllable from cockpit. Aileron area 51.7 sq. ft. (4.8 sq. m.) or 8.2% of wing area. Slotted flaps between ailerons and nacelles and between nacelles and fuselage. Total flap area 63.8 sq. ft. (5.9 sq. m.); depression 45 degrees.

FUSELAGE.—All-metal structure, made in four sections. Bulkhead rings and longitudinal stringers with heavy bulkhead frames at points of wing attachment and other concentrated loads. Openings reinforced by heavy stringers, with boxed-in sections for extra rigidity where required. All-metal covering with flush riveting and skin joints. Maximum depth 7 ft. 10 in. (2.4 m.), maximum width 4 ft. 8 in. (1.4 m.).

TAIL UNIT.—All-metal cantilever tailplane and elevators with twin fins and rudders as endplates. Fins of all-metal construction with span-wise stringers and metal skin covering. Total fin area 33 sq. ft. (3.1 sq. m.). Rudders of formed aluminium frames with metal covered nose-sections and stressed-skin covering. Total rudder area 36.8 sq. ft. (3.4 sq. m.). Tailplane of two-spar construction with spanwise stringers and stressed-skin covering. Negative incidence 1 degree. Tailplane area 64 sq. ft. (5.9 sq. m.), tailplane span 19 ft. 2 in. (5.8 m.). Elevators of formed sheet metal aluminium alloy frames with aluminium sheet covered nose-section, and fabric covering aft of spar. Trim-tabs in rudders and elevators. Rudders and elevators aerodynamically, dynamically and statically-balanced. Elevator area 50.9 sq. ft. (4.7 sq. m.).

LANDING GEAR.—Retractable type. Main landing wheels carried on oleo-pneumatic shock-absorber legs which retract backwards into engine nacelles and are completely enclosed. Doors closed when wheels fully down or fully up. Hydraulic operation, with independent hydraulic and pneumatic emergency systems. Full-swivelling and lockable tail-wheel retracts into fuselage.

POWER PLANT.—Two 2,300 h.p. Wright R-3350 Duplex-Cyclone eighteen-cylinder two-row radial air-cooled engines on welded steel-tube mountings and enclosed in NACA cowlings with G.E.C. cooling flaps. Direct fuel injection and two-speed superchargers. Underslung nacelles of sheet aluminium alloy construction with stressed bulkheads attached to main wing ribs and spars with longitudinal stringers and stressed skin. Hamilton Standard three-blade constant-speed full feathering airscrews, 12 ft. (3.6 m.) diameter. Minimum blade angle 16 degrees; maximum blade angle 82 degrees.

ACCOMMODATION.—Crew of two, pilot and rear-gunner. Access to the pilot's compartment is through a hinged section of the cockpit enclosure and is reached from the upper surface of the wing. The gunner's compartment is located in the aft section of the fuselage with entrance in the under section forward of the compartment.

ARMAMENT.—One 75 m/m. automatically-loading cannon and two .5 in. (12.7 m/m.) machine-guns in nose of fuselage. Two remotely-controlled turrets each armed with two .5 in. (12.7 m/m.) guns, one above and one below fuselage and controlled from position aft of wings. Periscope sights above and below fuselage. External wing racks for bombs, long-range tanks, chemical smoke tanks, etc.

DIMENSIONS.—Span 67 ft. 1 in. (20.46 m.), Length 51 ft. 8 in. (15,76 m.), Height 17 ft. 6 in. (5.34 m.).

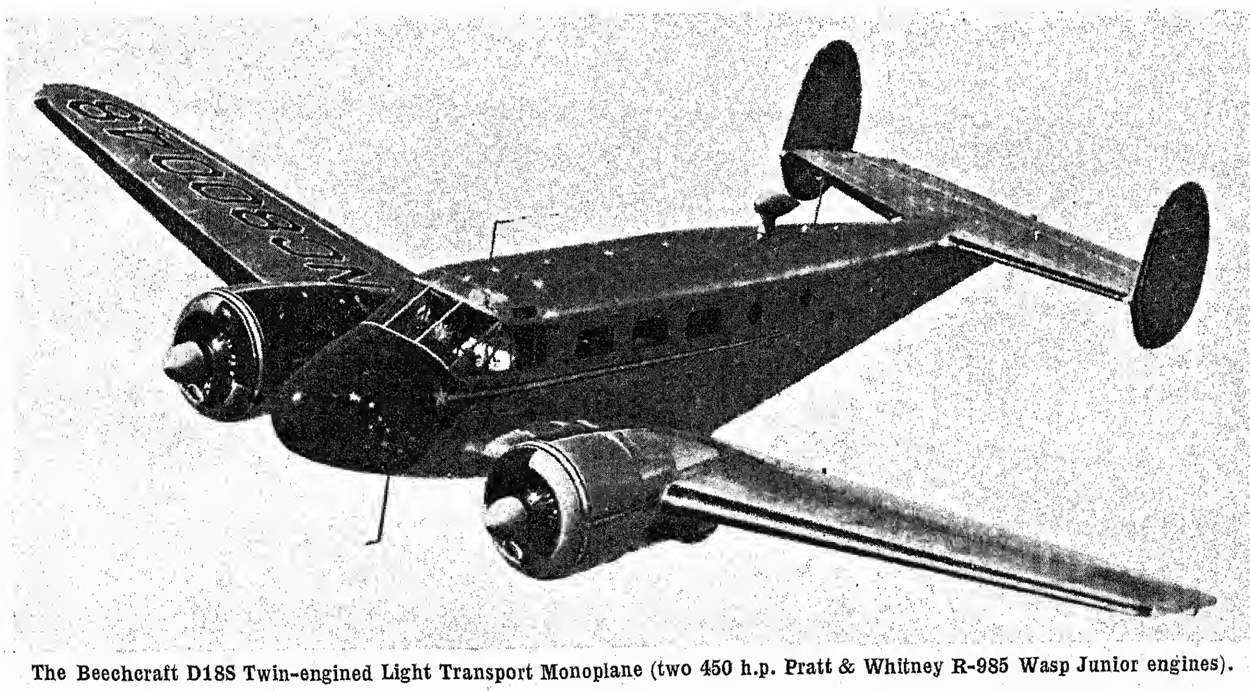
WEIGHTS.—Weight empty 23,320 lbs. (10,590 kg.), Weight loaded 29,900 lbs. (13,680 kg.). Various combinations of fuel, oil, external bombs, external long-range fuel tanks and smoke tanks may be carried up to maximum gross weight of 36,332 lbs. (16,480 kg.).

PERFORMANCE.—Maximum speed 395 m.p.h. (632 km.h.) at 20,000 ft. (6,100 m.), Landing speed 98.5 m.p.h. (157.6 km.h.), Emergency rate of climb at sea level 3,400 ft./min. (1,037 m./min.), Range (normal) 1,600 miles (2,560 km.), Maximum Range (with long-range tanks) 2,900 miles (4,640 km.).

THE BEECHCRAFT MODEL D18S.

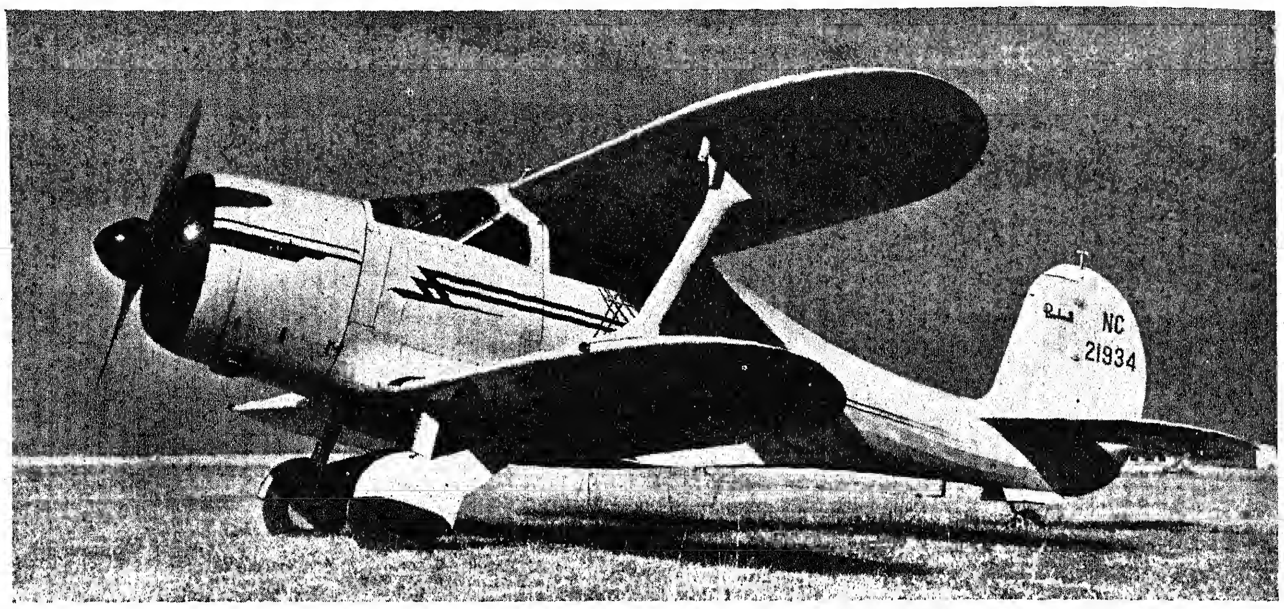
TYPE.—Twin-engined Light Transport.

WINGS.—Low-wing cantilever monoplane. Centre-section integral with the fuselage. Tapering outer wing sections. Structure consists primarily of a single beam, in the form of a welded tube monospar, which at approximately half-way to the tip is spliced to a duralumin girder. Continuous duralumin ribs are anchored at their ends by a light spar, which carries the aileron and flap hinges. Extruded duralumin stringers extend spanwise, and the whole is covered with a smooth skin, flush-riveted over leading-edge. Duralumin-framed ailerons and flaps, with fabric covering.



The Beechcraft D18S Twin-engined Light Transport Monoplane (two 450 h.p. Pratt & Whitney R-985 Wasp Junior engines).

BEECHCRAFT—*continued.*



The Beechcraft G17S Five-seat Cabin Biplane (450 h.p. Pratt & Whitney R-985 Wasp Junior engine).

Trimming-tab in left aileron. Electrical flap operation. Wing area 349 sq. ft. (32.4 sq. m.).

FUSELAGE.—Oval section metal structure, comprising built-up bulkheads and extruded-section stringers, the whole covered with a smooth skin, flush-riveted on the nose section, cowling and nacelles. Single steel-tube spar built into the fuselage to carry engine, landing gear and wing loads. Remainder of centre-section built up as wings.

TAIL UNIT.—Monoplane type with twin fins and rudders. Stressed-skin tailplane and fins. Rudder and elevators have welded steel-tube frames with fabric covering. Trimming-tabs on port rudder and on each half of elevator.

LANDING GEAR.—Retractable type. Wheels carried in forks and are electrically retracted backwards into engine nacelles. Air-oil shock-absorbers. Low-pressure wheels and hydraulic brakes of the single-disc ventilated type with controls for both pilot and co-pilot.

POWER PLANT.—Two 450 h.p. Pratt & Whitney R-985 Wasp Junior radial air-cooled engines. Hamilton-Standard constant-speed airscrews as standard equipment or Hamilton Standard hydraulic airscrews as optional equipment.

ACCOMMODATION.—Pilot's compartment in nose, seating two side-by-side, with dual controls. Passenger cabin seats five to seven passengers. Baggage compartments in extreme nose and behind cabin. Sound-proofing, controlled ventilation and heating.

DIMENSIONS.—Span 47 ft. 7 in. (14.5 m.), Length 34 ft. 3 in. (10.4 m.), Height 9 ft. 2½ in. (2.8 m.).

WEIGHTS.—Weight empty 5,609 lbs. (2,546 kg.), Weight loaded 8,500 lbs. (3,860 kg.) or 8,750 lbs. (3,980 kg.) with Hydromatic airscrews.

PERFORMANCE.—Maximum speed 230 m.p.h. (368 km.h.), Landing speed 55-77 m.p.h. (88-123 km.h.) with flaps full down, Initial rate of climb 1,280 ft./min. (390 m./min.), Service ceiling 22,000 ft. (6,710 m.), Range 1,615 miles (2,585 km.) with 286 U.S. gallons (1,082 litres) fuel.

THE BEECHCRAFT MODEL G17S.

TYPE.—Five-seat Cabin biplane.

WINGS.—Equal-span single-bay biplane with back stagger. Upper wing attached direct to the top of the fuselage with one I-type heat-treated steel interplane strut on either side of the fuselage. Duplicated flying-wires attached to front spar in upper wing and to fuselage at rear spar attachment of lower wing. Landing wires are attached to fuselage at front spar fitting of upper wing and to rear spar in lower wing. Wing structure consists of two wooden spars, wooden ribs and fabric covering. Statically and aerodynamically-balanced ailerons on upper wings and electrically-operated lift-flaps on lower wings. Wing area 296 sq. ft. (27 sq. m.).

FUSELAGE.—Oval structure of metal with two heat-treated steel trusses below lower longerons to carry all main loads. These trusses eliminate cross tubes in cabin and luggage compartments.

TAIL UNIT.—Cantilever monoplane type. Welded steel-tube framework for elevators and rudder, wood framework for tailplane and fin, all fabric-covered.

LANDING GEAR.—Retractable type. Hydraulic shock-absorbers, semi-balloon wheels and brakes. Electrical retraction. Retractable tail-wheel.

POWER PLANT.—One 450 h.p. Pratt & Whitney R-985 Wasp-Junior nine-cylinder radial air-cooled engine, driving a Hamilton Standard two-blade constant-speed airscrew. Engine-driven fuel pump with auxiliary hand-pump operated by remote control.

ACCOMMODATION.—Enclosed cabin to accommodate pilot, four passengers and their baggage. Adjustable front seats and wide seat across back of cabin. Full vision windows, ventilators and heaters. Large door on left side of cabin to give easy access to both front and back seats.

DIMENSIONS.—Span 32 ft. (9.76 m.), Length 25 ft. 9 in. (7.85 m.), Height 9 ft. 0 in. (2.74 m.)

WEIGHTS.—Weight empty 2,800 lbs. (1,270 kg.), Weight loaded 4,250 lbs. (1,928 kg.).

PERFORMANCE.—Cruising speed (300 h.p.) 200 m.p.h. (320 km.h.) at 10,000 ft. (3,050 m.), Landing speed 55-64 m.p.h. (88-102.4 km.h.) with flaps full down, Initial rate of climb 1,400 ft./min. (427 m./min.), Service ceiling 23,000 ft. (7,015 m.), Range 1,400 miles (2,240 km.) at 5,000 ft. (1,525 m.).

BELL.

BELL AIRCRAFT CORPORATION.

HEAD OFFICE: P.O. BOX 1, BUFFALO, N.Y.

WORKS: NIAGARA FALLS, N.Y. AND BURLINGTON, VT.

President and General Manager: Lawrence D. Bell.

First Vice-President: Ray P. Whitman.

Vice-President and Treasurer: Charles L. Beard.

Vice-President in charge of Engineering: D. Roy Shoults.

Executive Assistant to President and Secretary: Leston P. Faneuf.

The Bell Aircraft Corpn. was formed in 1935 by Lawrence D. Bell, formerly Vice-President and General Manager of the Consolidated Aircraft Corpn., R. P. Whitman, who was Assistant General Manager of Consolidated, and Robert J. Woods, Consolidated's Chief Engineer. When Consolidated moved its factory from Buffalo to San Diego, Cal., these three men remained in Buffalo to form the new company.

Most of the company's early business was in the nature of sub-contracting, but in July, 1937, it completed its first original design, the XFM-1 twin-engined long-range escort monoplane which incorporated many radical departures from conventional military aircraft, including twin shaft-driven pusher airscrews and an armament which included two 37 m/m. cannon and several .5 in. (12.7 m/m.) machine-guns. Thirteen Airacudas were built for the U.S. Army and before the last one was delivered the Bell company was ready with a new single-seat fighter, the P-39 Airacobra. This aeroplane also incorporated interesting innovations, including an Allison engine located aft of the cockpit and driving a tractor airscrew through an 8 ft. (2.44 m.) extension shaft and remote gear-box.

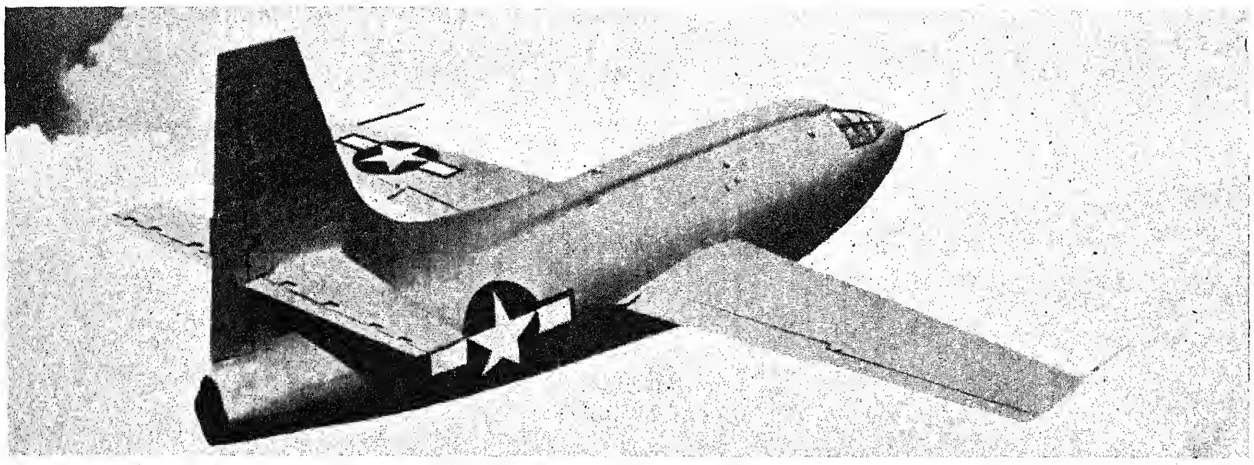
While the P-39 was still in production, the Bell Corpn. introduced its third new Army aircraft, the P-63 Kingcobra. This aeroplane incorporated many of the basic features of the P-39, including the tricycle landing-gear, cannon in the nose and engine behind the pilot. When the P-63 completely supplanted the P-39 on the Bell assembly lines in July, 1944, 9,588 Airacobras had been produced, more than half of which were delivered to Russia under Lend/Lease.

During the preliminary stages of the transition from P-39 to P-63, Bell was also engaged in the design, building and testing of the first American jet-propelled fighter, the P-59A Airacomet. This aeroplane, fitted with two jet units built by the General Electric Company to British designs, made its first flight on October 1, 1942, seventeen months after the first successful flight had been made in Great Britain.

The latest Bell jet-propelled fighter is the XP-83, a photograph and details of which appear on page 184c. Two prototypes were built.

Months before America's entry into the war, the Bell Aircraft Corpn. had begun a helicopter development programme. This was continued through the war years as a private venture,

BELL—*continued.*



The Bell XS-1 Single-seat Research Monoplane under test as a glider.

without seeking Government contracts. The result has been a series of helicopter designs incorporating important stability principles. In 1946 the company began the production of 500 of its Model 47 Helicopter for commercial, industrial and governmental uses, and was also developing and building other helicopters under Government contract.

THE BELL XS-1.

The XS-1 is the Army Air Force's first rocket-propelled aircraft and has been designed jointly by the A.A.F., Bell Aircraft Corporation and the National Advisory Committee for Aeronautics specifically to investigate supersonic flight problems. It was conceived early in 1945, and in 1946 was carried to altitude by a Boeing B-29 Superfortress, released and allowed to glide to earth. Its first flight under its own power took place at the Muroc Flight Test Base, California on December 9, 1946, after being dropped from a B-29.

The XS-1 was originally intended to be powered by a rocket unit wherein the fuel would be forced into the burners by a turbine pump, but on the first aircraft a pressurized system is employed. The turbine pump, which will allow the rocket fuel an endurance at 6,000 lbs. (2,722 kg.) static thrust of 4.2 minutes instead of 2.5 minutes with the pressurized system, is being incorporated in the second prototype.

The Bell Aircraft Corporation's contract specifies, *inter alia*, that the XS-1 must respond satisfactorily to controls at a Mach number of .8. Although this number has been exceeded in tests, these tests have also shown that the XS-1 is unlikely to achieve sonic speed in its original form.

Type.—Single-seat Rocket-propelled Monoplane for Supersonic Research.

Wings.—Cantilever mid-wing monoplane. Thin aerofoil section of 10% thickness/chord ratio. Aluminium-alloy structure with straight-tapered leading and trailing-edges and square tips. Trailing-edge flaps between ailerons and fuselage. Wing area 130 sq. ft. (12.08 sq. m.).

Fuselage.—All-metal structure of oval cross-section.

Tail Unit.—Cantilever monoplane type with tailplane mounted one-third way up fin. Dorsal fin extends forward to cockpit. Tailplane incidence adjustable in flight. Balanced rudder and elevators. Trim-tab in rudder.

Landing Gear.—Retractable tricycle type. Main wheels carried on short shock-absorber legs retract into fuselage and are enclosed by hinged doors. Nose-wheel retracts into fuselage and is fully enclosed. Compressed-air springing and retraction.

Power Plant.—Reaction Motors rocket unit consisting of four cylinders burning alcohol and liquid oxygen, with a total static thrust of 6,000 lbs. (2,722 kg.). Power output is controlled by selection of the number of cylinders to be fired at any one time, giving thrust of 1,500 lbs., 3,000 lbs., 4,500 lbs. or 6,000 lbs. (720 kg., 1,361 kg., 2,081 kg. or 2,722 kg.) at will. Rocket outlet in extreme stern of fuselage under rudder. Pressurized system employs gaseous nitrogen to force alcohol and liquid oxygen into burners. Maximum rocket endurance at 6,000 lbs. (2,722 kg.) $2\frac{1}{2}$ minutes.

Accommodation.—Enclosed pressurized cabin in nose for pilot. Access door on starboard side ahead of wing.

Dimensions.—Span 28 ft. 0 in. (8.54 m.), Length 31 ft. 0 in. (9.45 m.), Height (over rudder) 10 ft. 10 in. (3.3 m.).

Weights and Loading (Turbine pump version).—Weight empty (including 526 lbs. = 239 kg. test equipment) 4,892 lbs. (2,219 kg.), Rocket fuel 8,177 lbs. (3,709 kg.), Weight loaded 13,069 lbs. (5,928 kg.), Wing loading (maximum) 100.5 lbs./sq. ft. (491 kg./sq. m.).

Performance (Pressure-system version—estimated).—Maximum speed 1,000 m.p.h. (1,609 km.h.) at 60,000 ft. (18,290 m.), Rate of climb 28,000 ft./min. (8,535 m./min).

Performance (Turbine pump version—estimated).—Maximum speed 1,700 m.p.h. (2,736 km.h.) at 80,000 ft. (24,380 m.), Rate of climb 45,000 ft./min. (13,715 m./min.).

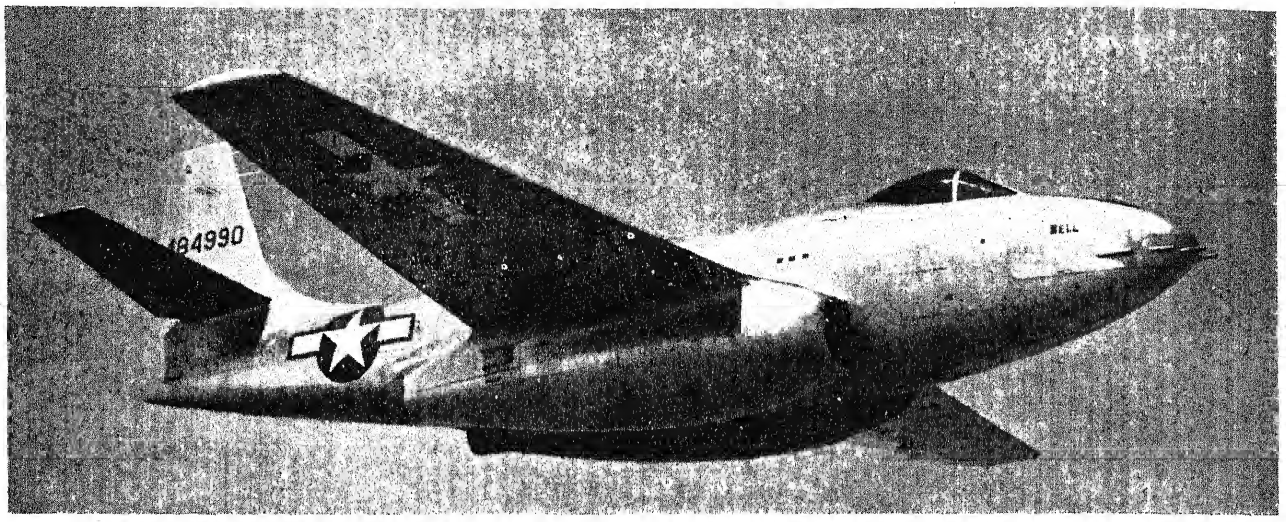
THE BELL XP-83.

Type.—Single-seat jet-propelled Fighter.

Wings.—Mid-wing cantilever monoplane. Laminar flow wing section with a $2\frac{1}{2}°$ geometric twist from the root chord to the tip chord, 2° dihedral, and an 8° 2′ sweepback. Wings installed with a

The Bell XS-1 standing alongside the Bell-built B-29 which takes it aloft.—(*Peter M. Bowers*).

***BELL**—continued.*



The Bell XP-83 Experimental Jet-propelled Single-seat Fighter (two General Electric I-40 turbo-jet units).

plus 1° root incidence and a minus $1\frac{1}{4}$° tip incidence. Structure comprises two main spars, an auxiliary spar, ribs, stringers and transverse bulkheads, the whole being covered with flush-riveted smooth metal skin with a glazed finish. Each outer panel is attached to a stub centre-section by a shear bolt and bushing at the top and bottom of the front and rear spars, these spars being continuous across the centre-section. Detachable wing-tips. Fowler type metal-covered flaps between the ailerons and wing roots. Ailerons of the pressure-balance type with pressure seals. Electrically-controlled trim-tab in left aileron. Hydraulic aileron boost employed in aileron system to reduce "stick" forces at high speeds. System has automatic disconnect feature in case of hydraulic failure. A hydraulically-operated dive-recovery flap on the under surface of each wing extends from the wing root outboard 60 in. (1.525 m.). Gross wing area 431 sq. ft. (40 sq. m.).

Fuselage.—All-metal semi-monocoque structure built principally of 24ST Alclad. Construction includes two longitudinal beams extending from the nose to the rear of the cockpit. From this point rearward, the longitudinal structure consists of 6 longerons of 75ST Alclad. Transverse framing and stringers reinforce the flush-riveted Alclad skin. A deck attached to the upper longerons serves to secure and support the tail assembly. A door in the bottom of the fuselage between the power-plant tail-pipes gives access to the radio and oxygen cylinders located in the fuselage.

Tail Unit.—Cantilever monoplane type. All-metal framework with metal-covered surfaces. Fixed trim-tab in the rudder. Tailplane incidence adjustable in flight by an electrically-controlled actuator.

Landing Gear.—Retractable tricycle type. Self-castering non-steerable nosewheel retracts backward into the fuselage and the main wheels are raised inwardly in the outer wings. A separate electrically-controlled actuator is provided for each strut, the nosewheel being actuated by a 1 h.p. motor and each main wheel by a $1\frac{1}{2}$ h.p. motor. Emergency extension of the gear is provided.

Power Plant.—Two General Electric I-40 (U.S. Army designation J-33) turbo-jet engines in nacelles beneath the wing roots and alongside the fuselage. Each unit is supported at three points to allow for normal expansion due to the heat of the engine. Three self-sealing interconnected fuel cells (908 U.S. gallons=3,437 litres) in fuselage and three interconnected self-sealing cells (123 U.S. gallons=466 litres) in each wing. External auxiliary fuel tanks may be carried on bomb racks under wings.

Accommodation.—Pilot's cockpit forward of the leading-edge of the wing. Enclosure is pressure-tight for high altitude flying. The pressurised area is bounded by the cabin floor, a bulkhead separating the cabin from the armament bay in front, a bulkhead immediately aft of the pilot and the canopy above. The "blister" canopy is of the sliding hatch type, may be locked in the open, close or in any intermediate position, and is jettisonable from any position. The heating, pressurising and ventilating systems are all combined into one main system, which maintains a substantially ambient altitude pressure up to 10,000 ft. (3,050 m.) and a constant 10,000 ft. (3,050 m.) cabin altitude pressure up to approximately 18,000 ft. (5,490 m.). A constant cabin differential of 2.75 lbs./sq. in. (0.19 kg./sq. cm.) is maintained from 18,000 ft. (5,490 m.) up, and is adjustable down to 1 lb./sq. in. (.07 kg./sq. c/m.) for combat. The cabin is ventilated by air exhausting through the cabin pressure regulator and cabin temperature may be adjusted by a thermostatic control.

Armament.—Varying combinations of forward-firing armament may be installed. Bomb racks under each outer wing.

Dimensions.—Span 35 ft. (10.67 m.), Length approximately 45 ft. (13.72 m.), Height (over fin) 15 ft. 3 in. (4.65 m.).

Weights and Loading.—Weight empty 16,022 lbs. (7,275 kg.), Weight loaded 21,723 lbs. (9,860 kg.), Wing loading 39.67 lbs./sq. ft. (193.59 kg./sq. m.).

Performance.—No data available.

THE BELL KINGCOBRA.

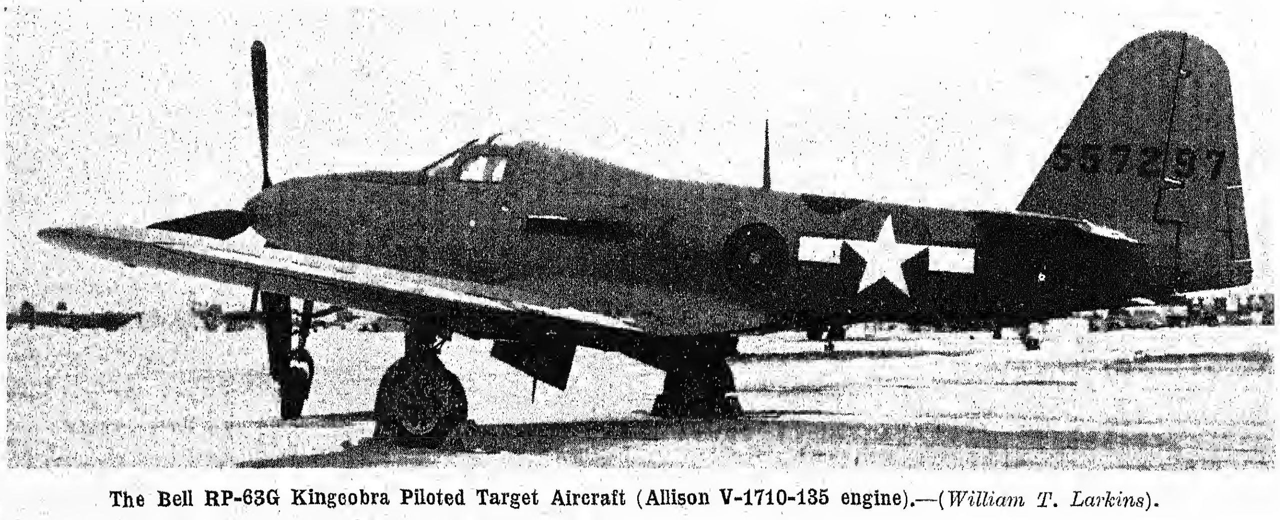
U.S. Army Air Forces designation : RP-63.

The P-63, the prototype of which first flew on December 7, 1942, was never used operationally by the U.S.A.A.F., the greater proportion of the wartime output being delivered to Russia under Lend/Lease.

A special modification of the P-63 has, however, been evolved to serve as a target in the U.S. Army's live ammunition training programme. This model, which carries the designation RP-63, is covered with a subsidiary skin of special duralumin-alloy armour plate against which 30-cal. lead and plastic frangible machine-gun bullets disintegrate harmlessly. Under the armour are special instruments which, when bullets strike the armour, transmit impulses to spot-lights in the centre of the airscrew hub and elsewhere, causing them to flash brightly.

The armour is heaviest round the cockpit. The windshield and cockpit side windows are of bulletproof glass, a steel grille covers the air intake and a steel guard the exhaust stacks. A special thick-walled hollow-blade airscrew is used.

The first target aircraft were the RP-63A and RP-63C models in which the armour ranged from $\frac{1}{8}$ to $\frac{1}{4}$ in. (3.2 to 6.4 m/m.) in thickness. With these aircraft gunners were restricted to shooting at the target from within a 30-degree angle each side



The Bell RP-63G Kingcobra Piloted Target Aircraft (Allison V-1710-135 engine).—(*William T. Larkins*).

The Bell Model 47 Two-seat Helicopter (175 h.p. Franklin engine).

of head-on. In the RP-63G the armour is increased to $\frac{1}{4}$ to $\frac{5}{16}$ in. (6.4 to 8 m/m.) in thickness to permit firing from all angles. Target discs each with a "bull's-eye" light in the centre are placed on the top, sides and underneath the fuselage amidships, in addition to the light in the nose of the spinner.

In spite of the greatly increased weight of the RP-63 target, it has a maximum speed of over 300 m.p.h. (480 km.h.) at 25,000 ft. (7,625 m.).

One P-63 has been fitted experimentally with wings with 35 degrees sweepback for research on the problems of supersonic flight. This aeroplane which was developed by the Bell Corporation in co-operation with the U.S. Navy Bureau of Aeronautics, carries the designation L-39. The L-39 is not intended to reach supersonic speeds but to provide flight data for future design.

The standard P-63 fighter was illustrated and described in the last issue of this Annual. It is no longer in production but the RP-63 target was still being delivered to the U.S. Army in 1946.

THE BELL MODEL 47 HELICOPTER.

U.S. Army Air Forces designation : YR-13.

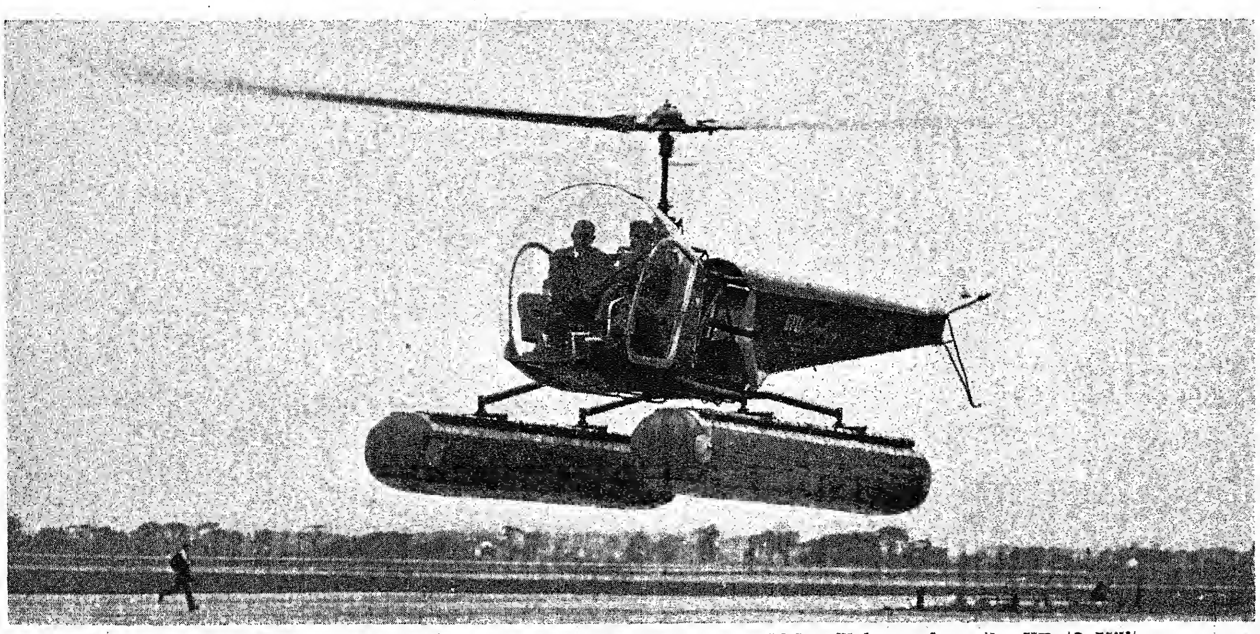
The Bell Aircraft Corporation had an experimental helicopter (Model 30) flying in the middle of 1943 following two years of development work. The Model 30 was tested by the U.S. Army under the designation XR-12. This model was superseded late in 1945 by the first of the Model 47 series.

On March 8, 1946, this helicopter received the first commercial licence (NC-1H) to be granted by the C.A.A., and on May 8, 1946, received Helicopter Approved Type Certificate No. 1 from the C.A.A. In 1946 the company began production of the Model 47 helicopter for commercial, industrial and government uses. Eighteen are on order for the U.S. Army and ten for the Navy.

A feature of this helicopter is the stabilizing system. The position of the rotor, which is mounted on the mast by a cardan universal joint, is governed by a stabilizing bar mounted just below the rotor hub and set at right angles to the two rotor blades. This stabilizing bar, which in the Model 47 is about 5 ft. (1.52 m.) long and weighted at the ends, is linked to the rotor in such a way that it tends to determine the plane of the rotor and maintain it generally horizontal irrespective of the angle of the mast. The rotor blades are not articulated but are rigidly connected to the hub, which is rocked about its longitudinal axis to control the rotor.

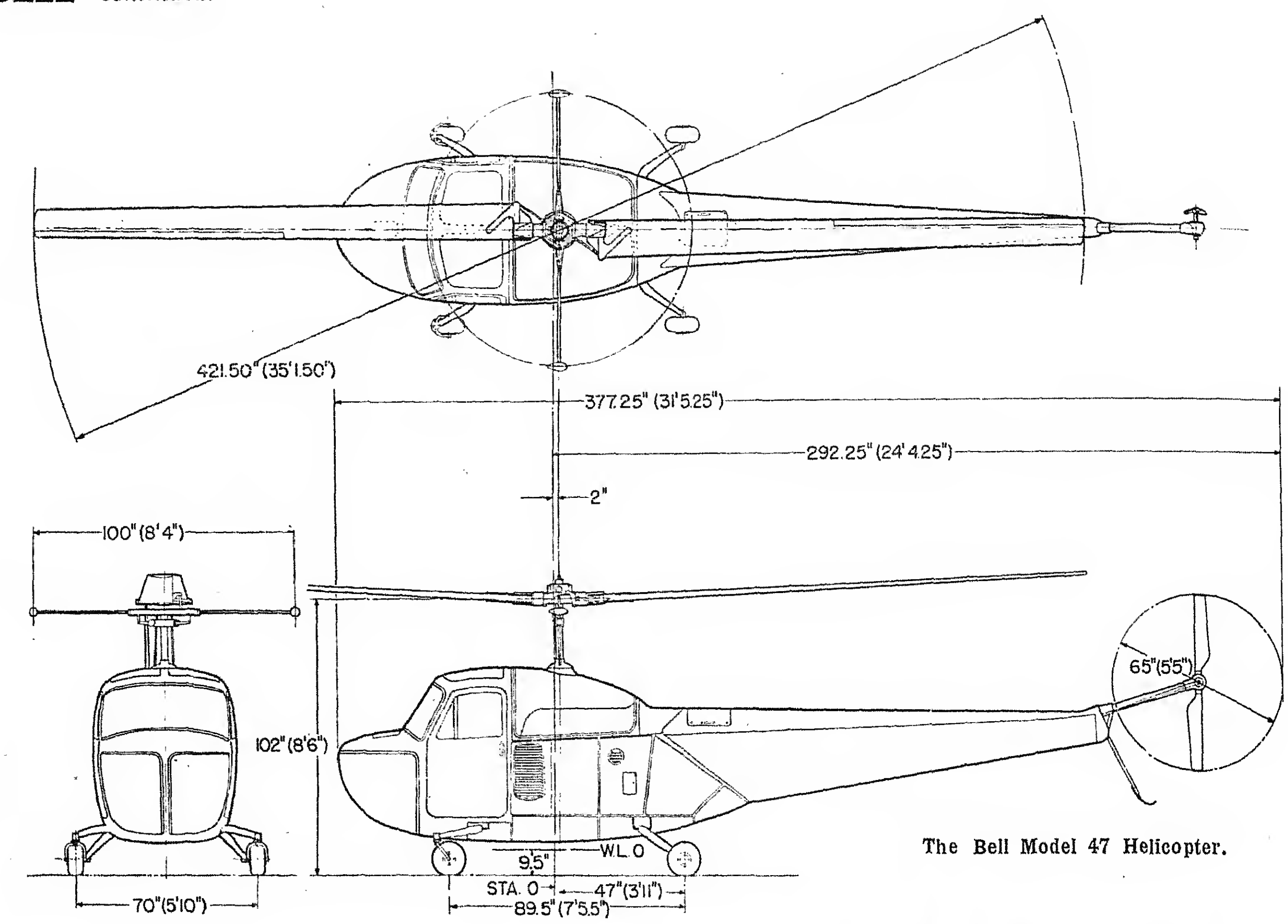
Type.—Two-seat Cabin Helicopter.

Rotors.—Two-blade main rotor and auxiliary two-blade controllable-pitch anti-torque propeller. Main rotor hub mounted on transmission mast by universal joint and provided with a stabilizing bar below and at right angles to the blades. A swash-plate revolving with the mast but free to move up and down provides cyclic pitch-control. Lower half of swash-plate which does not revolve alters pitch of the blades differentially for directional control. Main rotor drive through a centrifugal clutch and a two-stage planetary transmission with a 9 : 1 reduction ratio. Free-wheeling mechanism incorporated in transmission. Anti-torque propeller driven by a tubular shaft and controlled by cables



A Bell Model 47 Helicopter with the transparent cabin enclosure which will be used on the YR-13 Military version.—(*Martin & Kelman*).

BELL—*continued.*



The Bell Model 47 Helicopter.

and pulleys. Main rotor blades, of symmetrical aerofoil section, are of laminated wood with a steel insert in leading edge for strength and mass-balance. Anti-torque propeller blades likewise of laminated wood.

Fuselage.—In two sections. Forward section has a welded tubular steel framework which provides for mounting the engine and supporting the metal and Plexiglas cabin. Rear section is also a tubular structure, is triangular in cross-section and serves as a support for the anti-torque rotor drive-shaft.

Landing Gear.—Four-wheel type. The two forward self-castering wheels capable of swivelling through 360°, the two rear wheels fixed.

Power Plant.—One vertically-mounted 175 h.p. Franklin 6ALV-335 six-cylinder horizontally-opposed air-cooled engine with clutch, drive shaft and rotor assembly in an integral unit in a steel tube framework with the engine supported in rubber mounts at the top and bottom and attached to the welded framework of the forward fuselage. The engine-mounting structure has three attachment points for the rear fuselage.

Accommodation.—Enclosed cabin seating two side-by-side. Dual flight controls, include cyclic and collective pitch controls and anti-torque pedals. Cyclic controls tilts the main rotor and regulates translational flight. Collective pitch control lever, at left of each seat, controls the absolute angle of the main rotor blades, and incorporates a grip-type throttle. Anti-torque pedals control pitch of anti-torque rotor blade and determine heading of craft.

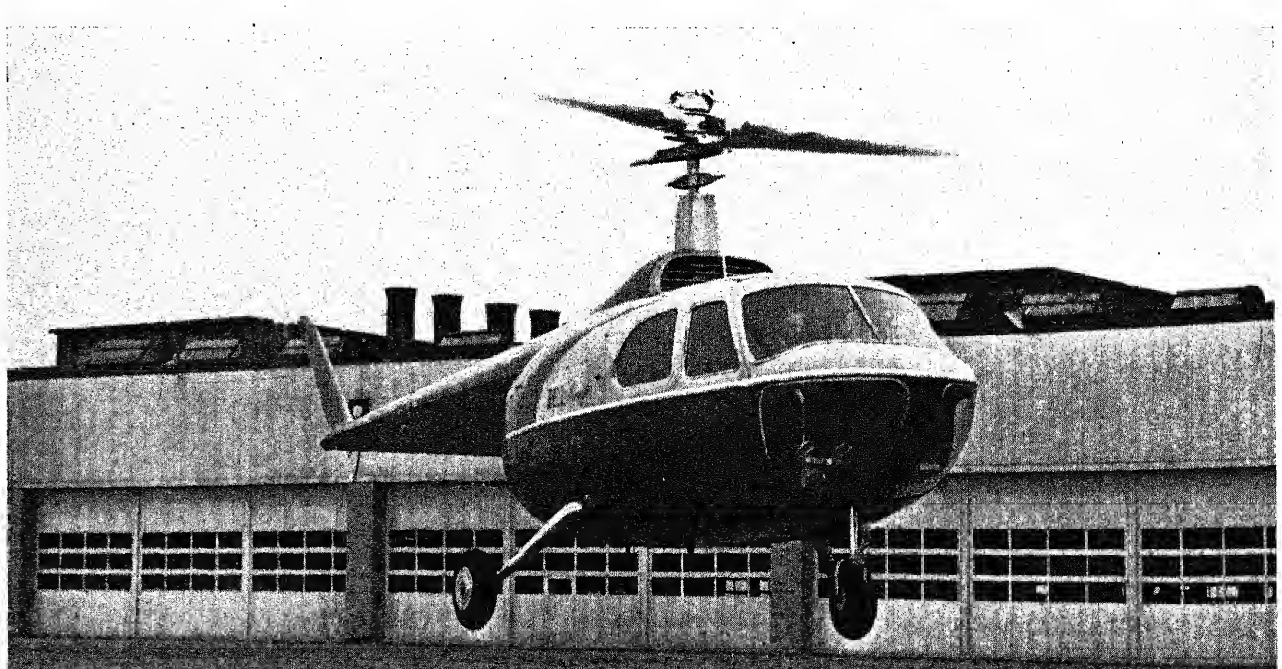
Dimensions.—Diameter of main rotor 33 ft. 7.5 in. (10.26 m.), Diameter of anti-torque rotor 5 ft. 5 in. (1.65 m.).

Weights.—Maximum weight 2,100 lbs. (956 kg.), Total useful load 612 lbs. (278 kg.).

Performance.—Cruising speed (75% power) 80 m.p.h. (128 km.h.), Rate of climb 950 ft./min. (290 m./min.), Service ceiling 9,700 ft. (2,960 m.), Range (with 32 U.S. gallons = 121 litres fuel) 200 mile (320 km.).

THE BELL MODEL 42 HELICOPTER.

The Model 42 is a larger all-metal five-seat helicopter for commercial use. The pilot and co-pilot's seat are in fore part



The Bell Model 42 Five-seat Commercial Helicopter (450 h.p. Pratt & Whitney R-985 Wasp Junior engine).

BELL—*continued.*

of cabin, with a cross bench for three passengers aft. The main rotor reduction gear ratio is 8.987 : 1. In addition to the free-wheeling coupling, the transmission includes a rotor brake. The landing gear is of the tricycle type. The power plant consists of a horizontally mounted 450 h.p. Pratt & Whitney Wasp Junior R-985 nine-cylinder air-cooled radial engine.

DIMENSIONS.—Diameter of main rotor 47 ft. 6 in. (14.48 m.), Diameter of anti-torque rotor 7 ft. 5 in. (2.25 m.).
WEIGHTS.—Design maximum weight 5,100 lbs. (2,315 kg.), Useful load 1,445 lbs. (656 kg.).
PERFORMANCE (Estimated).—Maximum speed 125 m.p.h. (200 km.h.) at sea level, Cruising speed (75% power) 100 m.p.h. (160 km.h.), Service ceiling 13,000 ft. (3,965 m.), Range (with 65 U.S. gallons= 246 litres fuel) 300 miles (480 km.).

BELLANCA.

BELLANCA AIRCRAFT CORPORATION.

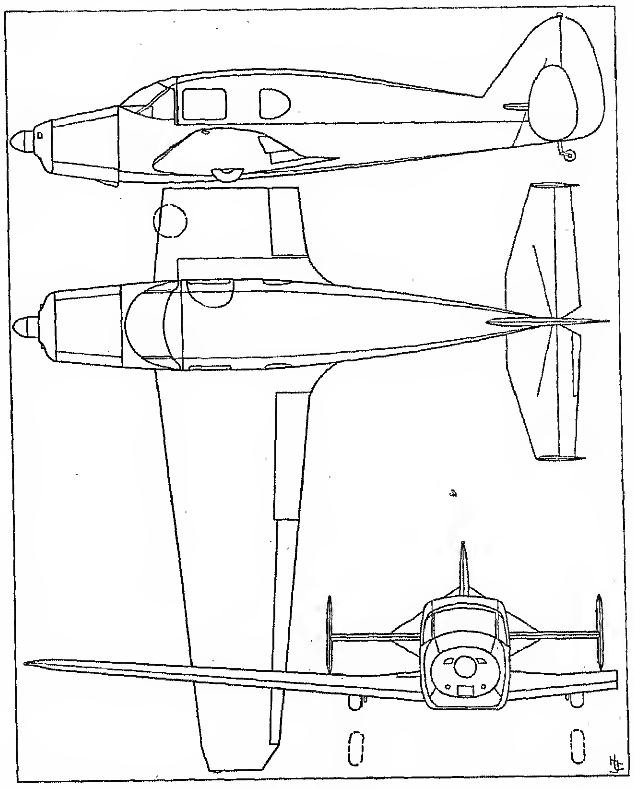
HEAD OFFICE, WORKS AND AERODROME: BELLANCA AIRPORT, NEW CASTLE, DELAWARE.
Established: December 30, 1927.
President and Chairman of Board of Directors: G. M. Bellanca.
Vice-President: A. F. Haiduck.
Secretary: H. L. Thompson.
Treasurer: M. L. Frank.

The Bellanca Aircraft Corporation was incorporated on December 30, 1927, taking over the old Bellanca Aircraft Corporation of America.

During the war the manufacture of commercial aircraft was suspended and all facilities were fully engaged in war production. Until the end of the war the company was engaged in sub-contract work, chiefly for Curtiss-Wright, Glenn Martin and the Bechtol-McCone Corpn. The entire production facilities of the company have now been re-converted for commercial aircraft production.

The 1946 Model 14-13 Cruisair is a development of the pre-war Cruisair. The prototype first flew on November 13, 1945, Approved Type Certificate No. 773 being awarded on March 12, 1946. Other civilian projects are under development.

A licence is now held by Northwest Industries, Ltd. (Canada), for the production of the Bellanca Senior Skyrocket single-engined commercial monoplane. A description of this aircraft will be found under "Northwest" (Canada).



The Bellanca Model 14-13 Cruisair Senior.

THE BELLANCA MODEL 14-13 CRUISAIR SENIOR.

TYPE.—Four-seat Cabin monoplane.
WINGS.—Cantilever low-wing monoplane. Aerofoil section Bellanca "B". Wooden two-spar structure with 15 full chordwise ribs and 15 former ribs in each wing. Plywood covering, with fabric over all. Plain-hinge trailing-edge flaps between ailerons and fuselage. Depression 43 degrees. Gross wing area 161 sq. ft. (14.95 sq. m.).
FUSELAGE.—Welded steel-tube structure with fabric covering.
TAIL UNIT.—Wire-braced monoplane type with additional stabilising fins at extremities of tailplane. Welded steel framework with fabric covering. Trim-tab in port elevator. Tailplane span 10 ft. 9¾ in. (3.29 m.).
LANDING GEAR.—Retractable two-wheel type. Each main wheel, on single shock-absorber leg, retracts backwards into wing leaving portion projecting. Manual operation by torque tube and chain drive. Track 8 ft. 10⅝ in. (2.71 m.). Non-retractable tail-wheel carried on sprung fork. Toe-operated hydraulic brakes on main wheels.
POWER PLANT.—One Franklin six-cylinder horizontally-opposed air-cooled direct-drive engine rated at 150 h.p. at 2,600 r.p.m. Welded steel-tube engine-bearers. Sensenich two-blade fixed-pitch airscrew, with Aeromatic two-blade variable-pitch airscrew optional. Two 20 U.S. gallon (76 litre) fuel tanks.
ACCOMMODATION.—Enclosed cabin seating four in two pairs. Rear seat 40 in. (101.6 c/m.) wide. Baggage compartment aft of rear seat. Moulded Plexiglas windscreen. Access door on starboard side.
DIMENSIONS.—Span 34 ft. 2 in. (10.41 m.), Length (tail up) 21 ft. $3\frac{11}{16}$ in. (6.5 m.), Height (tail down) 6 ft. 2½ in. (1.88 m.).
WEIGHTS AND LOADINGS.—Weight empty 1,200 lbs. (544 kg.), Useful load 900 lbs. (408 kg.), Weight loaded 2,100 lbs. (952 kg.), Wing loading 13 lbs./sq. ft. (63.48 kg./sq. m.), Power loading 14 lbs./h.p. (6.34 kg./h.p.).
PERFORMANCE.—Maximum speed 169.2 m.p.h. (272 km.h.) at 2,700 r.p.m., Cruising speed 153.6 m.p.h. (247 km.h.) at 2,435 r.p.m. Stalling speed (with flaps) 45 m.p.h. (72 km.h.), Rate of climb 1,130 ft./min. (344 m./min.), Take-off run (no wind) 162 yds. (148 m.).

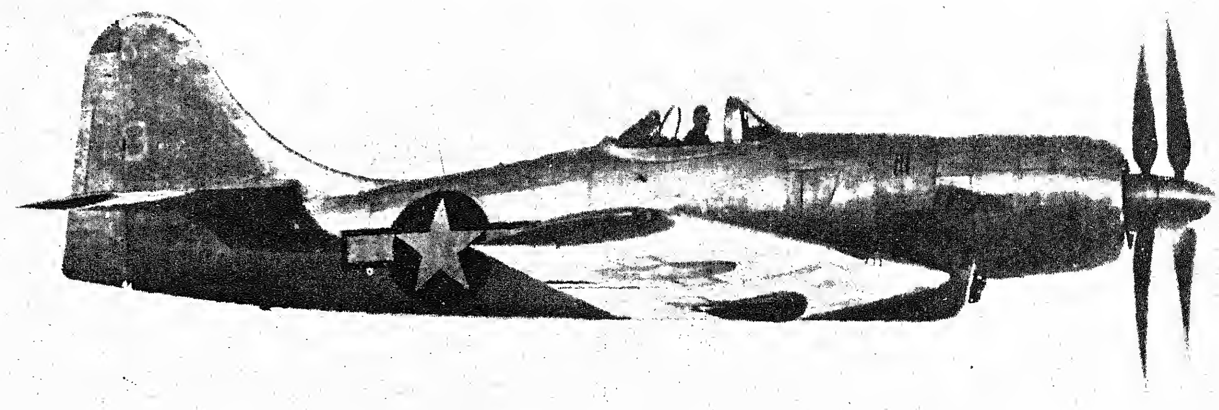
The Bellanca Model 14-13 Cruisair Senior Four-seat Cabin Monoplane (150 h.p. Franklin engine).

BOEING.

THE BOEING AIRCRAFT COMPANY.

HEAD OFFICE: SEATTLE 14, WASH.
AIRCRAFT MANUFACTURING DIVISIONS: SEATTLE, WASH., AND WICHITA, KANSAS.
Established: July, 1916.
Chairman: C. L. Egtvedt.
President: William M. Allen.
Assistants to President: O. W. Tupper, A. F. Logan and R. P. Holman.
Assistant to Executive Vice-President: T. J. Emmert.
Vice-President and Eastern Representative: J. P. Murray.
Vice-President in charge of Manufacturing: H. F. Brown.
Vice-President in charge of Engineering and Sales: Wellwood E. Beall.
Vice-President in charge of Experimental Production: F. P. Laudan.
Chief Engineer: Edward C. Wells.

BOEING—*continued.*



The Boeing XF8B-1 Single-seat Fleet Fighter (3,000 h.p. Pratt & Whitney R-4360 Wasp-Major engine).

Assistant Chief Engineer: L. A. Wood.
Secretary and Treasurer: H. E. Bowman.
WICHITA DIVISION.
Vice-President and Division Manager: J. E. Schaefer.
Executive Assistant to Division Manager: L. M. Divinia.
Chief Engineer: H. W. Zipp.
Assistant Secretary and Treasurer: Clif Barron.

The Boeing Aircraft Company is the wholly-owned manufacturing subsidiary in Seattle of the Boeing Airplane Company, the parent corporation. Boeing Aircraft Company of Canada, Ltd., is a direct subsidiary of the Boeing Aircraft Company. In addition, there is the Wichita Division of the Boeing Airplane Company in Wichita, Kan.

In the period between December 7, 1941, and August 14, 1945, the Boeing Company produced a grand total of 16,149 aircraft. The Seattle and the wartime Renton plants combined built 932 B-29 Superfortresses, 6,835 B-17 Fortresses, 226 Douglas DB-7B Bostons, 140 Douglas A-20C Havocs, three XC-97s, one XPBB-1 and one XF8B-1. The Wichita Division turned out 1,508 B-29 Superfortresses, 5,682 PT-17 Kaydet trainers and 512 Waco CG-4A gliders. The Canadian subsidiary built 275 Consolidated Vultee PB2B-1 and 32 PB2B-2 Catalina flying-boats.

With the end of the war the contracts for the B-29 were severely curtailed, to be finally terminated in May, 1946. The company had, however, visualised the production of a commercial version of the XC-97 to be known as the Stratocruiser and extensive plans for the development of this aircraft have resulted in orders being received up to July, 1946, from five major airline companies for forty-nine of these aircraft. In addition the U.S. Army has ordered a further ten examples of the military transport version of the Stratocruiser under the designation YC-97.

Another military contract now in hand is for sixty B-50 bombers, an improved version of the B-29 Superfortress, and work is proceeding on the development of the XB-47 jet-propelled bomber. Of the three XF8B-1 prototype naval fighters which have been completed, one was made available to the U.S. Army for test at Wright Field in 1946.

The Wichita Division is engaged in the production of the L-15A and of parts and assemblies for the B-50 and the Stratocruiser.

Production of the Boeing Kaydet training biplane ceased in February, 1945, after 10,346 had been built by the Wichita Division, but a licence for the manufacture of this aeroplane was granted to the Chinese Government in 1946.

THE BOEING MODEL 450.

U.S. Army Air Forces designation: XB-47.

The XB-47 is an experimental jet-propelled bomber which is under development for the U.S. Army. No details of this aircraft were available for publication at the time of writing.

THE BOEING MODEL 400.

U.S. Navy designation: XF8B-1.

TYPE.—Single-seat Carrier Fighter.

WINGS.—All-metal cantilever low-wing monoplane. Wing built in three main sections: centre-section and two outer wings. Single-spar structure. All-metal ailerons with spring-servo tab in each. Fowler-type trailing-edge flaps between ailerons and fuselage.

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with aerodynamically-balanced rudder and elevators. Trim-tabs in rudder and elevators.

LANDING GEAR.—Retractable two-wheel type. Main wheels carried on shock-absorber legs attached to outer ends of centre-section and retract backwards turning through 90 degrees to lie flat within wings. Fully enclosed by fairing plates and doors. Tail-wheel retracts forward into fuselage. Retractable deck-arrester gear.

POWER PLANT.—One Pratt & Whitney R-4360 Wasp-Major twenty-eight-cylinder four-row radial air-cooled engine rated at 3,000 h.p. for take-off and developing 3,600 h.p. war emergency power with water injection. Engine mounted as power-egg and quickly interchangeable. Two Aeroprop three-blade co-axial contra-rotating airscrews, 13 ft. 6 in. (4.1 m.) diameter.

ACCOMMODATION.—Pilot's cockpit with moulded blister canopy which slides for access. Controllable heating and ventilation.

ARMAMENT.—Six 20 m/m. cannon or six .5 in. (12.7 m/m.) machine-guns mounted three in each wing. Bomb load 6,400 lbs. (2,903 kg.) or alternatively two 2,000 lbs. (907 kg.) torpedoes may be carried externally. Racks for rocket projectiles under wings.

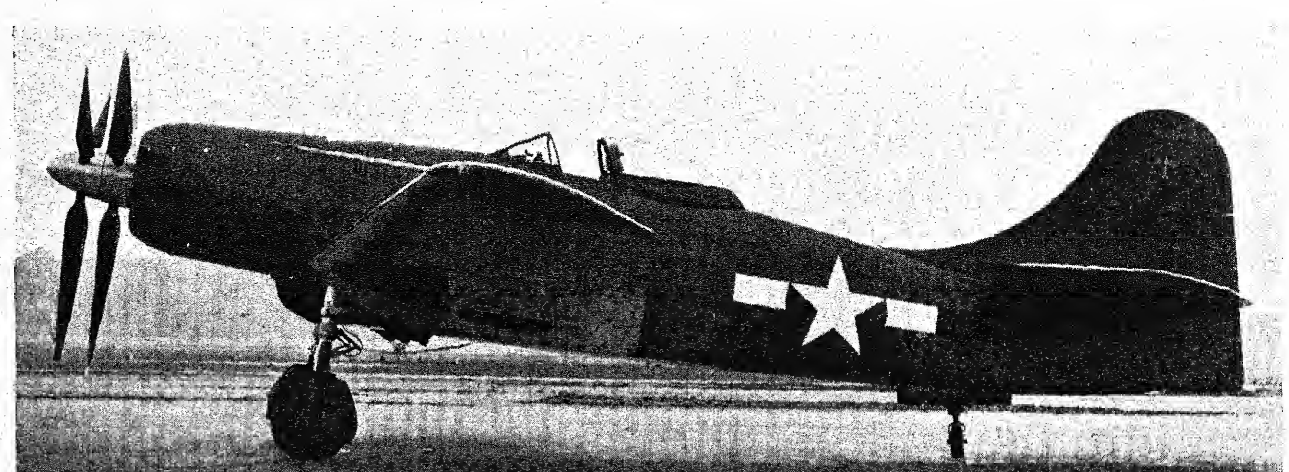
DIMENSIONS.—Span 54 ft. 0 in. (16.46 m.), Length 43 ft. 3 in. (13.17 m).

WEIGHTS AND LOADINGS.—No data avalable.

PERFORMANCE.—Maximum speed (with war emergency power) over 450 m.p.h. (724 km.h.), Maximum speed at normal power, over 425 m.p.h. (684 km.h.).

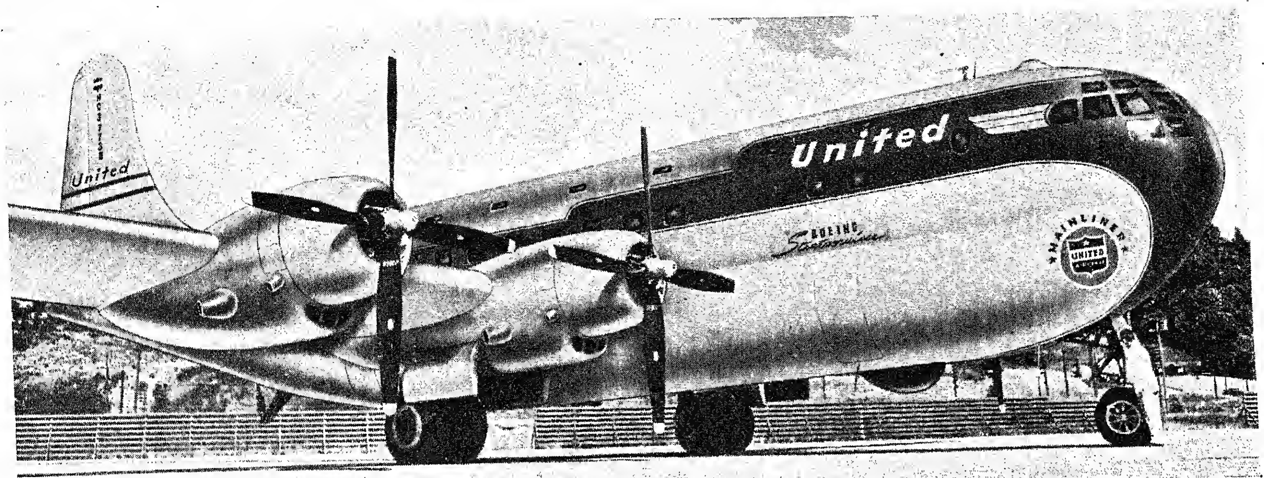
THE BOEING MODEL 377 STRATOCRUISER.

The Model 377 Stratocruiser is the civil development of the military Model 367 or YC-97, all prototype trials having been conducted with the military model. Stratocruisers have been ordered by Pan American World Airways, Northwest Airlines, United Air Lines, the American Airlines System, Swedish



The Boeing XF8B-1 Single-seat Fleet Fighter (3,000 h.p. Pratt & Whitney R-4360 Wasp-Major engine).

***BOEING**—continued.*



The Boeing Model 377 Stratocruiser as it will appear in the colours of United Airlines.

Airlines (S.I.L.A.), and the British Overseas Airways Corpn.

TYPE.—Four-engined Airliner.

WINGS.—Low-mid-wing cantilever monoplane. Boeing 117 aerofoil section. Aspect ratio 11.58. All-metal two-spar stressed-skin structure similar to that of the YC-97 and B-29. Electrically-operated Fowler-type flaps. Built-in thermal anti-icing system. Gross wing area 1,720 sq. ft. (159.8 sq. m.).

FUSELAGE.—All-metal semi-monocoque structure of inverted figure-8 cross-section designed for pressurization. Same structure as for YC-97. Maximum width of fuselage 11 ft. (3.35 m.), Maximum depth 15 ft. 2½ in. (4.65 m.), Ground clearance 1 ft. 10½ in. (0.55 m.).

TAIL UNIT.—Cantilever monoplane type as for YC-97. Fixed surface of two-spar stressed-skin construction with built-in thermal anti-icing system. Movable surfaces have metal frames and fabric covering and are aerodynamically and mass-balanced. Trim-tabs in elevators and rudder. Tailplane span 43 ft. (13.1 m.).

LANDING GEAR.—Retractable tricycle type as for YC-97. All three units with dual wheels, main wheels 4 ft. 8 in. (1.42 m.) diameter, nose-wheels 3 ft. (0.915 m.) diameter. Pedal-operated service brakes and hand-operated emergency brakes operated by separate hydraulic systems. Wheel track 28 ft. 5.6 in. (8.62 m.). Wheel base 36 ft. 1.16 in. (11 m.). Minimum turning radius (approximate) 29 ft. (8.85 m.). Fuselage static position 2° nose-up.

POWER PLANT.—Four Pratt & Whitney R-4360 Double-Wasp twenty-eight-cylinder four-row radial air-cooled geared and turbo-supercharged engines each developing a maximum output of 2,800 h.p. and with a take-off output of 3,500 h.p. with water-injection. Hamilton Standard or Curtiss Electric four-blade constant-speed full-feathering and braking airscrews 16 ft. 7 in. (5 m.) in diameter. All four engine nacelles quickly detachable and interchangeable. Built-in fuel cells in wings with total capacity of 7,055 U.S. gallons (26,670 litres). Provision for external fuel tankage for additional 1,200 U.S. gallons (4,542 litres).

ACCOMMODATION.—Two-deck fuselage, the upper deck accommodating the control cabin and the main passenger compartment and the lower deck a passenger lounge and two cargo holds. Control cabin in nose seats two pilots side-by-side with dual controls, navigator, engineer and radio operator. Various arrangements and furnishings of main upper deck passenger compartment permit seating for from 60 to 100 passengers. Standard arrangement accommodates a total of 81 passengers, 67 in main compartment and 14 in lower deck lounge. Circular stairway interconnects the two compartments. Main-cabin entrance on port-side aft on upper deck level. Lower rear cargo door with built-in steps may be used to give access to main cabin *via* lounge stairway. In a sleeper version main cabin may be fitted with 28 upper and lower berths plus 5 seats, in addition to 14 seats in lounge. Fully-equipped galley with cupboard space and vacuum containers for hot or cold foods and liquids. Men's and ladies' dressing rooms and toilets. Lower-deck fore and aft cargo compartment doors have sills at truck-level height. Capacity of compartments:—control cabin 505 cub. ft. (14.3 cub. m.), main upper deck passenger compartment 4,300 cub. ft. (121.7 cub. m.), lower passenger lounge 500 cub. ft. (14.15 cub. m.), ladies' dressing room 225 cub. ft. (6.4 cub. m.), men's dressing room 225 cub. ft. (6.4 cub. m.), galley 170 cub. ft. (4.8 cub. m.), forward cargo hold 680 cub. ft. (19.24 cub. m.), rear cargo hold 220 cub. ft. (6.2 cub. m.). Heights of fuselage doors:—main entrance door 9 ft. 10 in. (3 m.), forward cargo hold door 4 ft. 11 in. (1.5 m.), rear car hold door 4 ft. 5 in. (1.34 m.). Width of main cabin (inside linings) 10 ft. 4½ in. (3.16 m.). Complete automatic air-conditioning equipment with pressurization permitting operation at 15,000 ft. (4,575 m.) with sea-level cabin atmosphere and at 25,000 ft. (7,625 m.) with equivalent cabin pressure of 6,000 ft. (1,830 m.), combined radiant and convection heating, cabin cooling and ground air-conditioning with self-contained power supply. Auxiliary power for air-conditioning, electric power requirements, heat and thermal anti-icing provided by two separately-fueled gas-turbines, one in each outboard engine nacelle.

ACCOMMODATION (Stratofreighter).—The entire fuselage space can be made available for freight in a version known as the Stratofreighter. In this version the lower deck lounge becomes a third cargo hold. Large "clam-shell" doors under rear end of fuselage, powered hoist and powered overhead rail along roof of upper deck permit loading of heavy freight direct from truck or ground to any desired location in main compartment, which is 74 ft. 6 in. (22.7 m.) long. Pressurization is maintained in Stratofreighter and refrigeration and thermostatically controlled heating systems will provide special temperatures in any or all compartments if desired. Total cargo volume (four compartments) 6,140 cub. ft. (173.8 cub. m.), Maximum payload 41,000 lbs. (18,620 kg.).

DIMENSIONS.—Span 141 ft. 3 in. (43 m).), Length 110 ft. 4 in. (33.65 m.) Height 33 ft. 3 in. (10.14 m.).

WEIGHTS AND LOADINGS (Stratocruiser).—Weight empty 74,110 lbs. (30,645 kg.), Designed disposable load 55,890 lbs. (25,375 kg.), Designed normal take-off weight 130,000 lbs. (59,020 kg.), Landing weight 121,700 lbs. (55,252 kg.), Wing loading 75.5 lbs./sq. ft. (368.6 kg./sq. m.), Power loading 9.3 lbs./h.p. (4.2 kg./h.p.).

PERFORMANCE (Stratocruiser).—Maximum cruising speed (1,900 h.p. per engine) 340 m.p.h. (544 km.h.) at 25,000 ft. (7,625 m.), Service ceiling over 30,000 ft. (9,145 m.), Three-engine ceiling 28,000 ft. (8,540 m.), Take-off run (at 130,000 lbs.=59,020 kg. take-off weight) 1,700 yds. (1,554 m.), Landing run (at 105,000 lbs.=47,520 kg. landing weight) 1,867 yds. (1,707 m.).

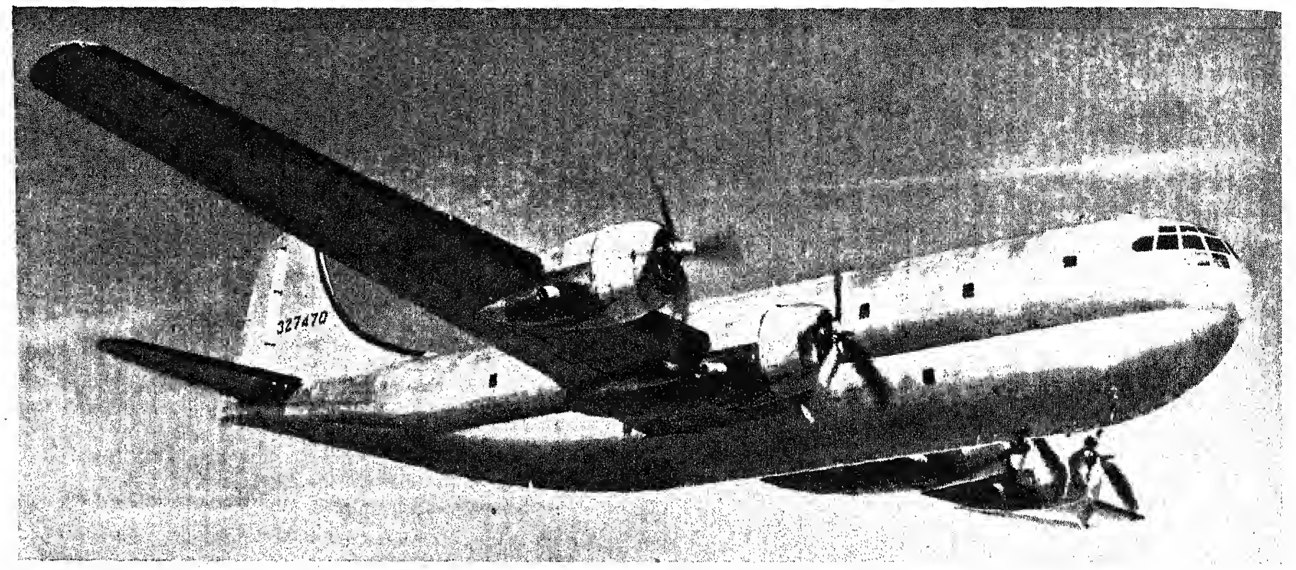
THE BOEING MODEL 367.

U.S. Army Air Forces designation: YC-97.

The Model 367 is a transport development of the B-29 Superfortress which has served as the prototype for the Model 377 Stratocruiser airliner.

The Boeing Stratofreighter, the cargo version of the Stratocruiser.

BOEING—*continued.*



The Boeing XC-97 Military Transport (four Wright R-3350-23 engines).

The Model 367 has the same wings, tail surfaces and landing-gear as the B-29 but has a fuselage which has twice the volume and is 12 ft. (3.66 m.) longer than that of the Superfortress. The new fuselage is of the two-deck type and in cross-section resembles an inverted figure 8, achieved, in effect, by building one fuselage section on top of another, the lower and shorter section being faired into the upper. The lower section is of the same diameter as the B-29 whereas the upper section has a width of about 11 ft. (3.35 m.). The two-deck arrangement with two separate cabins below and a main cabin 78 ft. (23.8 m.) long above permits unusual versatility in using the aircraft for military transport purposes.

Under the rear fuselage, large loading doors and a ramp permit the loading of wheeled or tracked vehicles, and an electrically-powered cargo-hoist running along the entire length of the fuselage can pick up loads from the trucks or from the ground through the loading doors. Two fully-loaded 1½-ton trucks or two light tanks can be driven into the fuselage, the drive-up ramp being raised and lowered by the cargo hoist. Adequate cargo handling and tie-down equipment is provided. The cabins can also be arranged to accommodate more than 100 fully-equipped troops, or be fitted out as a hospital transport.

The standard crew for the YC-97 is composed of pilot, co-pilot, flight engineer, radio operator and navigator. The entire fuselage, except for the tail storage section, is pressurised.

On January 9, 1945, the prototype XC-97, carrying a payload of more than 20,000 lbs. (9,072 kg.) flew across the American continent from Seattle to Washington, D.C., a distance of 2,323 miles (3,720 km.) in 6 hours 3 mins., representing an average speed of 383 m.p.h. (615 km.h.). The flight was made at a height of 30,000 ft. (9,145 m.).

Three XC-97s were built and these are being followed by ten YC-97s in three different versions of the basic design. The first six YC-97s will be powered with Wright R-3350 engines, while the YC-97A and YC-97B will have Pratt & Whitney R-4360 engines.

The general structure of the YC-97 is similar to that of the Model 377 (which see).

Dimensions.—Span 141 ft. 3 in. (43.1 m.), Length 110 ft. 4 in. (33.64 m.), Height 38 ft. (11.6 m.).

Weights.—Weight empty 70,000 lbs. (31,780 kg.), Weight loaded 135.000 lbs. (61,290 kg.), Landing weight 105,000 lbs. (47,670 kg.).

Performance (Estimated).—Maximum speed 400 m.p.h. (640 km.h.), Cruising speed 340 m.p.h. (544 km.h.), Operating range 3,500 miles (5,600 km.), Operating ceiling 30,000 ft. (9,145 m.).

THE BOEING MODEL 345 SUPERFORTRESS.

U.S. Army Air Forces designation : B-29, XB-39, XB-44, B-50, and F-13A.

The original specification for a large four-engined bomber to succeed the B-17 Fortress was issued by the U.S. War Department in January, 1940, but it was considerably modified some months later to incorporate increased armament and load requirements. To meet the original specification the Boeing company designed the Model 341, and this was modified into the Model 345 to incorporate the later requirements.

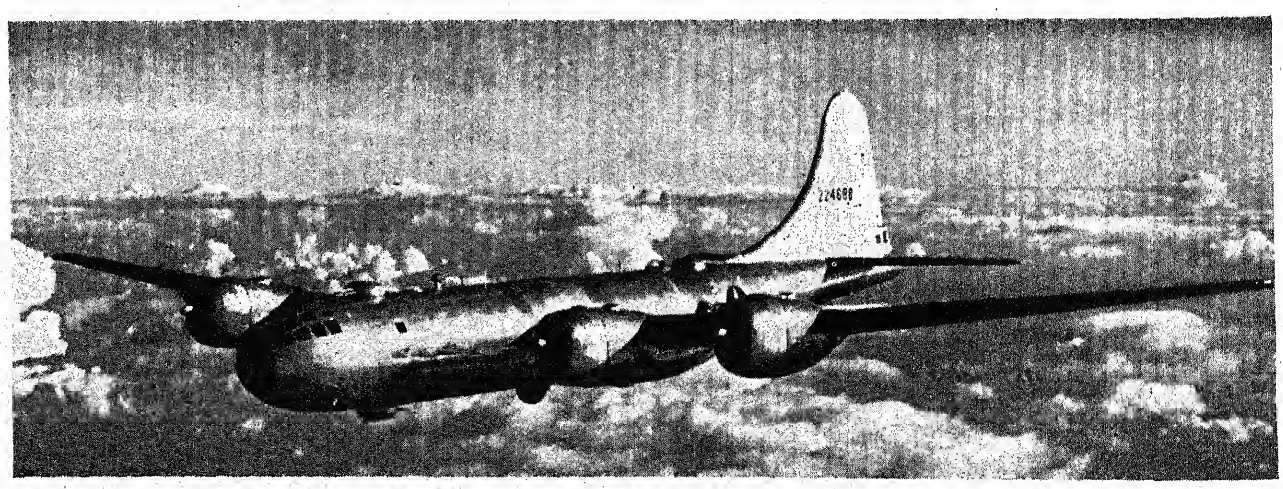
The contract for three XB-29 prototypes was placed with the Boeing company on August 24, 1940, and a service development order for 13 YB-29's was placed in the following May. With America's entry into the war a vast production programme for the B-29 was initiated, involving five main production plants and hundreds of sub-contractors.

The first XB-29 prototype built at Seattle flew on September 21, 1942, and the first YB-29 built at Wichita flew on April 15, 1943.

The B-29 was first reported in action on June 5, 1944, in an attack on railway yards at Bangkok, Siam, and on June 15 the first raid was made on Japan from bases in China. From that date attacks on the Japanese mainland were steadily stepped up, mainly from bases in the Marianas and on Guam, with forces of up to 450 and 500 Superfortresses. A B-29 dropped the first atomic bomb on Hiroshima, Japan, on August 6, 1945.

The following are the principal models and modifications of the Superfortress :—

B-29. Four Wright R-3350-23 engines. Built by Boeing (Wichita), Bell (Atlanta) and Martin (Omaha). In later B-29's



The Boeing B-29 Superfortress Heavy Bomber (four Wright R-3350-23 engines).

The Boeing B-29 Superfortress Heavy Bomber (four Wright R-3350-23 engines).—(*William T. Larkins*).

20 m/m. gun in tail-turret removed and a four-gun turret replaced the forward upper fuselage two-gun turret.

B-29A. Four Wright R-3350-57 engines. Built by Boeing (Renton).

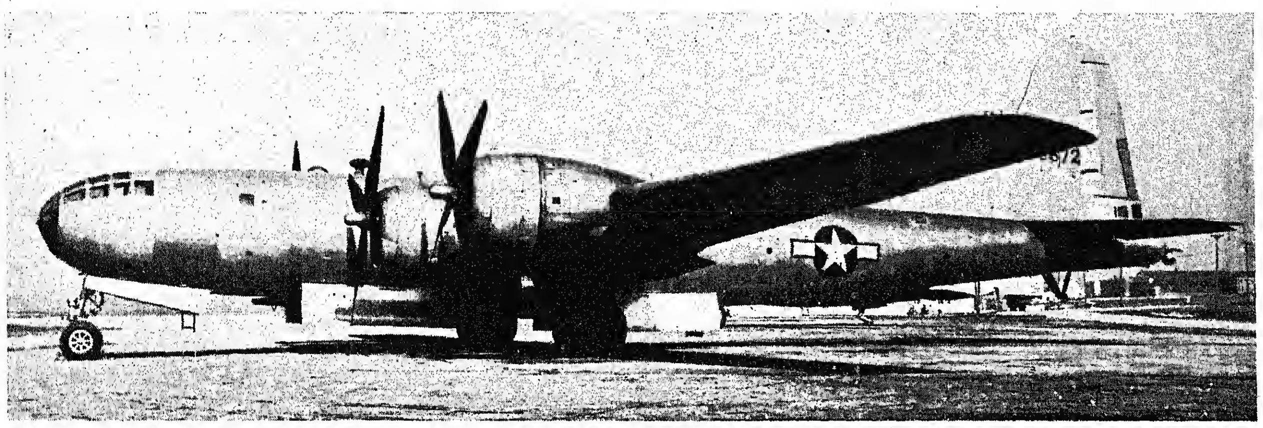
B-29B. Four Wright R-3350-51 engines. Fuselage turrets and sighting blisters removed. A new three-gun tail turret and two .5 in. (12.7 m/m.) hand-held waist guns on special mountings in gunner's pressurised compartments. Reduction of drag gave 10 m.p.h. (16 km.h.) increase in speed and reduction in weight permitted an additional 3,000 lbs. (1,360 kg.) of bombs to be carried. Evolved as a result of battle experience and used for precision bombing, mainly at night. B-29B so built that turrets could be added, consequently there were many combinations of gun-power available. Built by Bell.

B-29C and D. Cancelled after VJ-Day, the B-29D being superseded by the B-50 (which see).

XB-44. B-29A fitted with four 3,000 h.p. Pratt & Whitney R-4360-33 Wasp-Major twenty-eight-cylinder radial air-cooled engines in quickly-detachable nacelles. Installation designed and built by Pratt & Whitney Aircraft. Three converted. Served as prototype for the B-50.

B-50. Current production version of the Superfortress with four Pratt & Whitney R-4360 Wasp-Major engines with double turbo-superchargers and driving four-blade constant-speed full-feathering and reversible airscrews. Lighter wings and lighter weight landing-gear with ball-bearing quick-retracting mechanism. New and larger tail surfaces. The B-50 will have an estimated maximum speed of 425 m.p.h. (680 km.h.) and a range of 1,700 miles (2,720 km.).

The description which follows refers to the standard B-29A, which is still in service in U.S.A.A.F. bomber squadrons at home



The Boeing B-29B Superfortress Heavy Bomber (four Wright R-3350-51 engines).—(*William T. Larkins*).

XB-29E. A specially fitted B-29 which is being used as a flying laboratory.

F-13A. B-29A equipped as a long-range high-altitude photographic-reconnaissance aircraft. Special camera installations included trimetrogon, K-22, K-18 or special flash-bomb night aerial cameras. Full B-29 armament and long-range fuel tanks retained. F-13A's did most of the high-altitude mapping of Japan before the surrender, and were also used as recording camera and observation aircraft during the 1946 Bikini atomic bomb test operations.

XB-39. Experimental modification of the YB-29 fitted with four 3,000 h.p. Allison V-3420-A16 twenty-four-cylinder liquid-cooled engines. The power-plant installation was designed, built and installed by the Power-plant Development Division of the General Motors Corporation. One only.

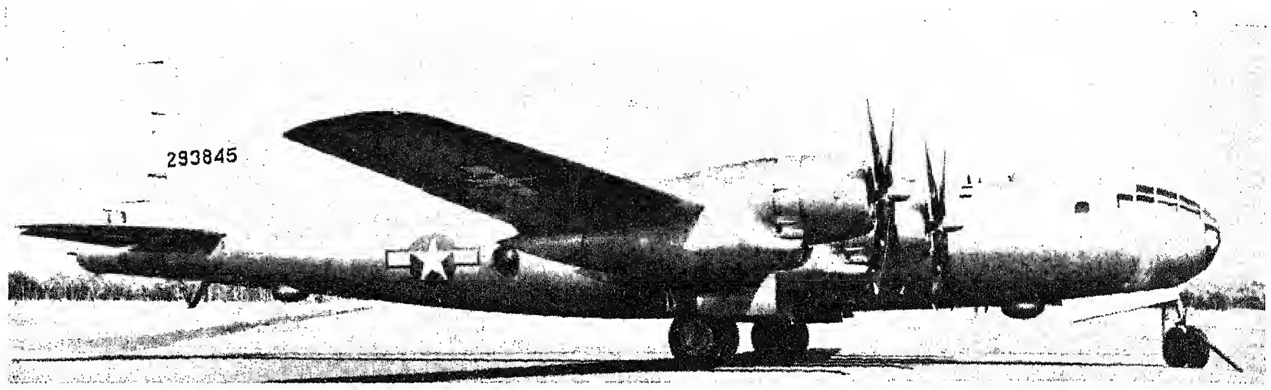
and with the occupation forces overseas. Information concerning the B-50 was still restricted at the time of writing.

TYPE.—Four-engined Heavy Bomber.

WINGS.—Mid-wing cantilever monoplane. Boeing 117 aerofoil section. Aspect ratio 11.5/1. Dihedral 4½ degrees. 7 degrees sweep-back on leading-edge, straight trailing-edge. Centre-section and two outer sections with detachable wing-tips. All-metal web-type structure covered with a flush-riveted butt-jointed metal skin. Detachable leading-edge to give access to controls, etc. Electrically-operated flaps of the extensible type which when fully extended increase the wing area by 19 per cent. The trailing-edge of the flaps between the inboard nacelles and fuselage extend aft of the normal wing trailing-edge line and hook downward to decrease aerodynamic interference between wings and body and over tail when flaps extended. Statically and aerodynamically-balanced ailerons fitted with combination trim and servo tabs. Gross wing area 1,739 sq. ft. (1,615 sq. m.).

The Boeing XB-39 version of the Superfortress with four 3,000 h.p. Allison V-3420-A16 engines.—(*William T. Larkins*).

BOEING—*continued.*



The Boeing XB-44 Superfortress (four 3,000 h.p. Pratt & Whitney R-4360-33 Wasp-Major engines).

Fuselage.—Circular section semi-monocoque structure in five sections. Built up of a series of circumferential bulkheads and frames, extruded longerons and stringers and a flush-riveted and butt-jointed stressed metal skin. The stringers are riveted to the skin and the circumferentials are attached to the stringers by means of clips. Three pressurised compartments, one forward and one aft of the bomb-bay and one in the extreme tail. Crawl tunnel over the bomb-bays interconnects the two forward compartments but the tail compartment is isolated.

Tail Unit.—Cantilever monoplane type with single fin and rudder. All-metal fixed surfaces, and metal-framed fabric-covered aerodynamically and statically-balanced control surfaces. Controllable trim-tabs.

Landing Gear.—Retractable tricycle type. Main gear has two oleo-pneumatic shock-struts and twin wheels. Double nose wheel has single strut. Electrical retraction, the main wheels being raised backwards into the inboard engine nacelles and the nose wheel into a well in the fuselage below the flight deck. Hydraulic wheel-brakes. Retractable tail bumper skid.

Power Plant.—Four 2,200 h.p. Wright R-3350-57 eighteen-cylinder radial air-cooled engines, each engine with two General Electric exhaust-driven turbo-superchargers mounted vertically, one on each side of the nacelle. Hamilton-Standard Hydromatic four-blade constant-speed full-feathering airscrews 16 ft. 7 in. (5 m.) diameter. Self-sealing fuel cells integral with wing structure. Normal capacity 5,608 U.S. gallons (21,227 litres). Self-sealing oil tank in each nacelle.

Accommodation.—Crew of ten to fourteen. Normal crew consists of pilot, co-pilot, navigator, bombardier, engineer, radio-operator and four gun-control operators. Forward pressurised compartment accommodates bombardier, pilot and co-pilot side-by-side with aisle in between, navigator facing forward behind pilot, engineer facing aft behind co-pilot and radio-operator behind engineer. Engineer's station has all power-plant controls and instruments but pilot's master throttle controls may override engineer's throttles. Crawl-tunnel over bomb-bays connects with second pressurised compartment which contains three gun-sighting stations in transparent blisters, one on top and one on each side of the fuselage. Tail-gunner's pressurised compartment in extreme tail of fuselage. All crew positions armoured or protected with armoured *flak* curtains. The three pressurised compartments are served by two superchargers driven off two inboard engines.

Armament.—Four General Electric remotely-controlled and electrically-operated turrets, two above and two below the fuselage. Forward upper turret with four 0.5 in. (12.7 m/m.) guns, remainder with two 0.5 in. (12.7 m/m.) guns each. Bell electrically-operated tail turret with two 0.5 in. (12.7 m/m.) guns. Five sighting stations, one in the nose, three in the middle pressurised compartment and one in tail compartment. Mid-upper station controls either or both upper turrets, side sighting stations control lower rear turret, nose sighting station controls lower front turret and tail station control over turret. Some stations have secondary control over certain other turrets but only one sight may be in control of a given turret at one time. Two bomb-bays, one forward and one aft of the wing centre-portion which passes through the fuselage, and in order that the balance of the aircraft is preserved during bomb-dropping a system is used whereby bombs are dropped alternately from the two bays. Total maximum bomb load 20,000 lbs. (9,072 kg.). Electrically-operated bomb-bay doors.

Dimensions.—Span 141 ft. 3 in. (43.1 m.), Length 99 ft. (30.2 m.), Height (over tail) 27 ft. 9 in. (8.46 m.).

Weights and Loadings.—Weight empty 74,500 lbs. (33,823 kg.), Normal loaded (combat) weight 120,000 lbs. (54,480 kg.), Maximum permissible loaded weight 140,000 lbs. (63,560 kg.), Wing loading 80 lbs./sq. ft. (391 kg./sq. m.), Power loading 15.8 lbs./h.p. (7.15 kg./h.p.).

Performance (at normal loaded weight).—Maximum speed 351 m.p.h. (562 km.h.) at 25,000 ft. (7,625 m.), Climb to 25,000 ft. (7,625 m.) 43 min., Range (maximum continuous cruiser power) 2,850 miles (4,560 km.) or 12.8 hours at 10,000 ft. (3,050 m.).

THE BOEING MODEL 299 FORTRESS.

U.S. Army Air Forces designations : B-17, XB-38, XB-40, F-9, XC-108, BQ-7, CB-17 and TB-17.

U.S. Navy designation : PB-1.

The Fortress was originally designed to meet a bomber specification issued by the U.S. Army Air Corps in 1934. The prototype first flew on July 28, 1935, and the first Y1B-17 of a production order of thirteen was delivered to the Air Corps in March, 1937. In January, 1939, an experimental Y1B-17A fitted with turbo-supercharged engines was delivered to the Army Air Corps. Following successful trials with this aircraft an order for 39 was placed for this model under the designation B-17B.

B-17B. Four 1,000 h.p. Wright R-1820-51 engines with exhaust driven superchargers. First B-17B delivered to the Army in June, 1939.

B-17C. Four 1,200 h.p. Wright R-1820-65 engines. Similar to B-17B except armament increased from five to seven 0.30 in. (7.7 m/m.) guns. Side gun blisters abandoned in favour of plain openings. Twelve B-17s ferried across the Atlantic in the Spring of 1944 for service with the R.A.F. These were the first Fortresses to go into combat operations in a daylight raid on Brest on July 24, 1941.

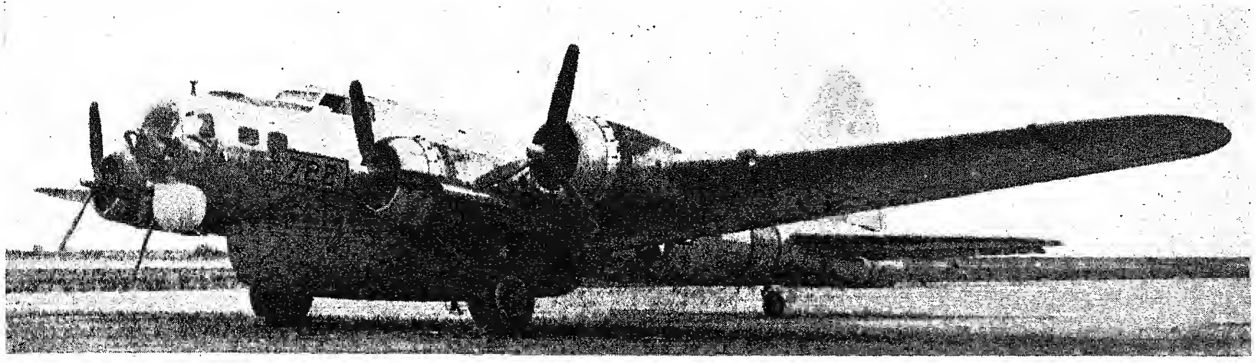
B-17D. Similar to B-17C but incorporating self-sealing tanks and armour protection for the crew. Later all B-17Cs were converted to B-17Ds.

B-17E. Major re-design and put into large-scale production by Boeing, Douglas and Vega. First Fortress to incorporate power-driven turrets and a tail-gun position. The total armament consisted of eleven 0.5 in. (12.7 m/m.) machine-guns. Enlarged horizontal and vertical tail-surfaces. First B-17E flew in September, 1941.

B-17F. Similar to the B-17E. Fitted with additional wing fuel tanks and with external racks under inner wings for a maximum of two 4,000 lb. (1,816 kg.) bombs. Later models fitted with four R-1820-97 engines.

B-17G. Four 1,200 h.p. R-1820-97 engines. Similar to B-17F. Various armament changes. Fitted with a remotely-controlled two-gun Bendix chin turret in place of hand-operated nose guns. In later versions the two 0.5 in. (12.7 m/m.) side

A Boeing B-17E Fortress modified experimentally in Great Britain to take a Bristol B-16 nose turret mounting a 40 m/m. cannon.



The Boeing B-17H Flying Fortress, a conversion from the B-17G for Air/Sea Rescue duties.—(*William T. Larkins*).

nose guns were reinstated, the open waist guns were replaced by staggered enclosed waist guns, and a new tail gun mounting with increased angles of fire and a reflector sight instead of ring and bead was installed.

B-17H. Conversion of the B-17G for Air/Sea Rescue duties. Carries airborne lifeboat under fuselage and is fitted with special search radar equipment.

XB-38. One B-17E fitted with four Allison V-1710-89 liquid-cooled engines in place of the standard air-cooled units, and stressed to load factors of the B-17F.

YB-40. One XB-40 and thirteen YB-40s were modified B-17Fs equipped to serve as escorts for bomber formations in European theatre. Armed with fourteen .5 in. (12.7 m/m.) guns in twin mountings. No bombs carried and bomb-bays fitted to carry extra ammunition which was chute-fed to gun positions. Were not successful and were soon withdrawn from operations.

CB-17. B-17s withdrawn from operations were stripped of armament and used for general utility transport duties under the designation CB-17.

TB-17. Stripped B-17s used for miscellaneous training duties.

XC-108. One B-17E converted to serve as staff aircraft for General Douglas McArthur. Turrets, armour and bomb-racks removed and interior re-arranged to contain three passenger compartments, office facilities and galley. Single .5 in. (12.7 m/m.) nose gun and twin .5 in. (12.7 m/m.) guns in tail retained. XC-108A was a B-17E converted to cargo transport. XC-108B was a fuel tanker conversion.

F-9. A photographic reconnaissance version of the B-17F. Three cameras were installed in the nose and extra fuel tanks carried in the bomb-bay.

BQ-7. Stripped B-17 equipped as a pilotless radio-controlled explosive missile.

PB-1. U.S. Navy modification of the B-17G for over-sea observation duties. Stripped of armament and fitted with special radar equipment for weather observation experiments. PB-1W in service in U.S. Coast Guard for long-range Air/Sea Rescue duties.

Apart from the many variants of the Fortress detailed above, the B-17 is used for many experimental duties, including serving as a launching platform in the U.S.A.A.F. guided-missile programme and in radar and radio-control experiments. Radio-controlled B-17s took part in the Bikini atomic-bomb tests and on the conclusion of these operations two crewless B-17s were flown from Hawaii to Muroc Field, California, a distance of 2,400 miles (3,862 km.) under the control of another aircraft of the same type.

In all, 12,731 B-17s of all models were built, from the XB-17 prototype to the last B-17G which was delivered to the U.S.A.A.F. in April, 1945.

The description below applies to the B-17G, the last operational bomber version of the Fortress. This version is still in service in U.S.A.A.F. bomber squadrons both at home and with the occupation forces overseas.

Type.—Four-ongined Bomber.

Wings.—All-metal midwing cantilever monoplane. Aerofoil section varies from NACA 0018 at root to NACA 0010 at tip. Aspect ratio 7.58/1. Taper ratio 2.4 : 1. Incidence 3½°. Dihedral 4½°. Sweepback on leading-edge 8¼°. Structure, consisting of two inner sections carrying the engine nacelles, two outer sections and two detachable tips, chiefly of aluminium-alloy, with two spars, ribs and stressed-skin covering. Electrically-operated split trailing-edge flaps on inner wing sections, ailerons on outer sections. Flaps and ailerons covered with fabric. Ailerons fitted with control trimming-tabs. Gross wing area 1,420 sq. ft. (132 sq. m.).

Fuselage.—Semi-monocoque structure, consisting of bulkheads and circumferential stiffeners, tied together with longerons and longitudinal stiffeners, the whole covered with a smooth metal stressed skin.

Tail Unit.—Cantilever monoplane type. Aluminium-alloy framework, with fixed surfaces covered with smooth metal sheet and movable surfaces covered with fabric. Elevators and rudder fitted with controllable trimming-tabs.

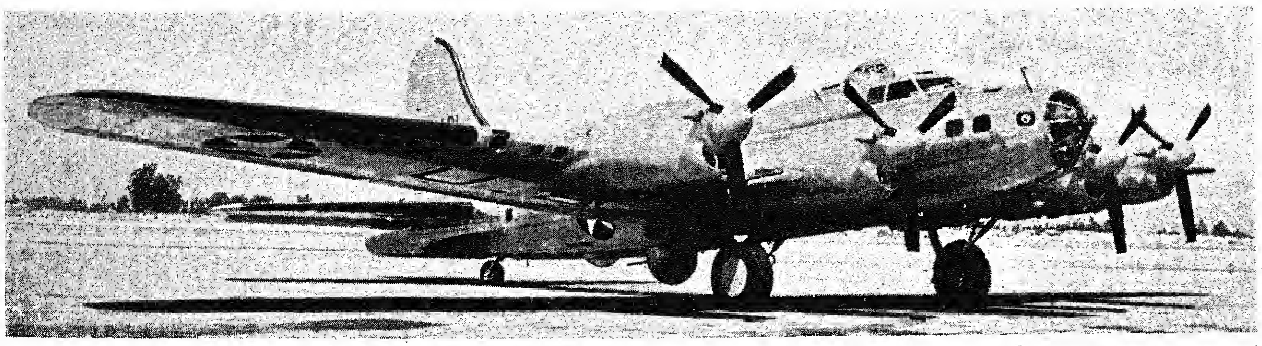
Landing Gear.—Retractable two-wheel type. Air-oil shock-absorber units. Hydraulic wheel-brakes. Electrical retraction. Retractable tail-wheel.

Power Plant.—Four 1,200 h.p. Wright R-1820-97 nine-cylinder radial air-cooled engines with General Electric Type B-22 exhaust-driven turbo-superchargers installed in the undersides of the engine nacelles. Hamilton-Standard three-bladed constant-speed full-foathering airscrews 11 ft. 7 in. (3.54 m.) diameter. Self-sealing fuel tanks in wings. Normal fuel capacity carried in six tanks in the inner wing sections 1,700 U.S. gallons (6,435 litres). Nine self-sealing auxiliary feeder tanks in outer wings. Two self-sealing droppable ferry tanks may be carried in bomb-bay. Maximum capacity of all wing tanks 2,780 U.S. gallons (10,523 litres). Self-sealing hopper oil tank in each nacelle. Oil capacity 148 U.S. gallons (561 litres).

Accommodation.—Normal crew of six to ten. Bomb-aimer's compartment in extreme nose. Pilot's compartment seating two side-by-side with dual controls in front of leading-edge of wing. Aft of pilot's position is an upper electrically-operated two-gun turret. Radio-operator's position amidships. Two gun positions aft of the wings, one two-gun electrically-operated turret beneath the fuselage and one position in the extreme tail. Equipment includes automatic pilot, two-way radio and radio "homing" equipment. Oxygen equipment with points of supply for each member of the crew, de-icers on leading-edges of wings, tail-plane and fin, two collapsible dinghies, etc.

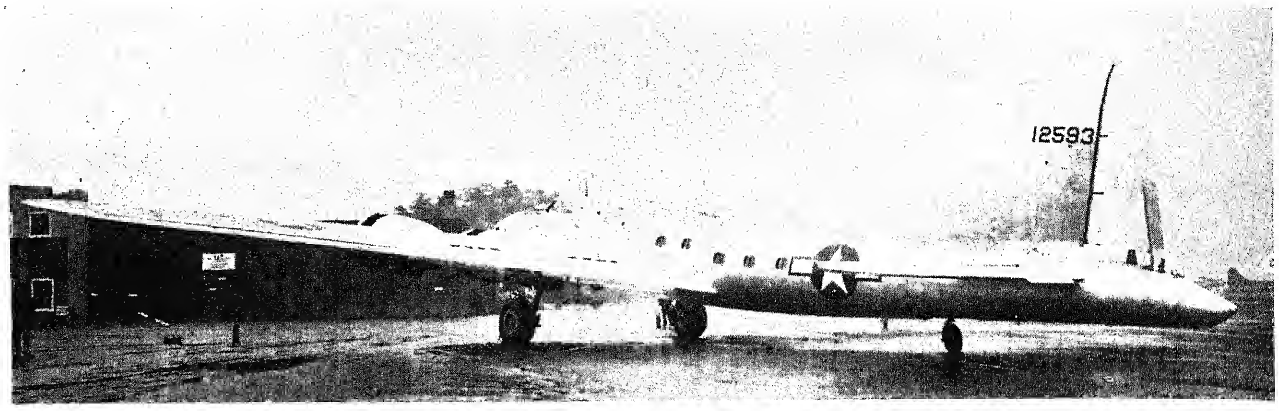
Armament.—Thirteen .5 in. (12.7 m/m.) machine-guns. From nose to tail these are : two, remotely-controlled, in a chin turret beneath the plastic bomb-aimer's nose ; two in cheek mountings, one on either side of the plastic nose ; two in an electrically-operated turret on top of the fuselage just aft of the pilot's cockpit ; one manually-operated firing through the top of the fuselage above the radio-operator's compartment ; two in a Sperry electrically-operated ball turret below the fuselage ; two on hand-operated mountings and firing through side ports, one on each side of the fuselage midway between wings and tail ; and two in the extreme tail. Internal bomb stowage in fuselage between the main spar frames, the bomb-bay occupying the full cross-section of the fuselage. Normal capacity of bomb-bay is 6,000 lbs. (2,724 kg.). Largest bomb which can be carried internally is the 2,000 lb. (907 kg.). External racks no longer fitted.

Dimensions.—Span 103 ft. 9 in. (31.6 m.), Length 74 ft. 9 in. (22.8 m.), Height 19 ft. 1 in. (5.8 m.).



The Boeing XB-38, an experimental version of the Fortress fitted with Allison V-1710-89 engines.—(*William T. Larkins*).

BOEING—*continued.*



The Boeing XC-108, a specially-converted B-17E for the personal use of General McArthur.

WEIGHTS AND LOADINGS.—Weight empty 32,720 lbs. (14,855 kg.), Normal weight loaded 49,500 lbs. (22,475 kg.), Maximum overloaded weight 60,000 lbs. (27,216 kg.).

PERFORMANCE.—Maximum speed 295 m.p.h. (472 km.h.) at 25,000 ft. (7,625 m.), Climb to 25,000 ft. (7,625 m.) 41 min., Service ceiling 35,000 ft. (10,670 m.), Normal range (maximum bomb load and normal fuel) 1,100 miles (1,760 km.) at 220 m.p.h. (352 km.h.) at 25,000 ft. (7 625 m.).

THE BOEING L-15A.

The L-15A is a light two-seat monoplane of unconventional design which has been built to meet U.S. Army requirements for liaison duties. Its primary function is that of an aerial observation post, particularly for spotting and directing artillery fire. Other uses include communications, photography, supply-dropping, wire-laying and aerial pick-up. Without having its airscrew removed the L-15A can be towed as a glider at speeds up to 165 m.p.h. (264 km.h.). The landing gear may consist of either wheels, skis or floats, and attachments are provided for the installation of the Brodie gear to permit hooking on or taking off from a cable.

The general arrangement of the aircraft can be seen in the accompanying illustration of the XL-15 prototype. The entire aircraft can be quickly dismantled and loaded on a standard 2½-ton Army truck. Each wing panel is attached to the centre-section by four bolts. The tail surfaces and single boom are also quickly removable. The cantilever landing-gear is attached to the nacelle by two bolts and the wheels may be rotated inwards to decrease the width for loading.

The crew of two have full visibility in all directions, and the rear seat, which can face either forward or aft, is easily removable to provide space for special equipment or light freight.

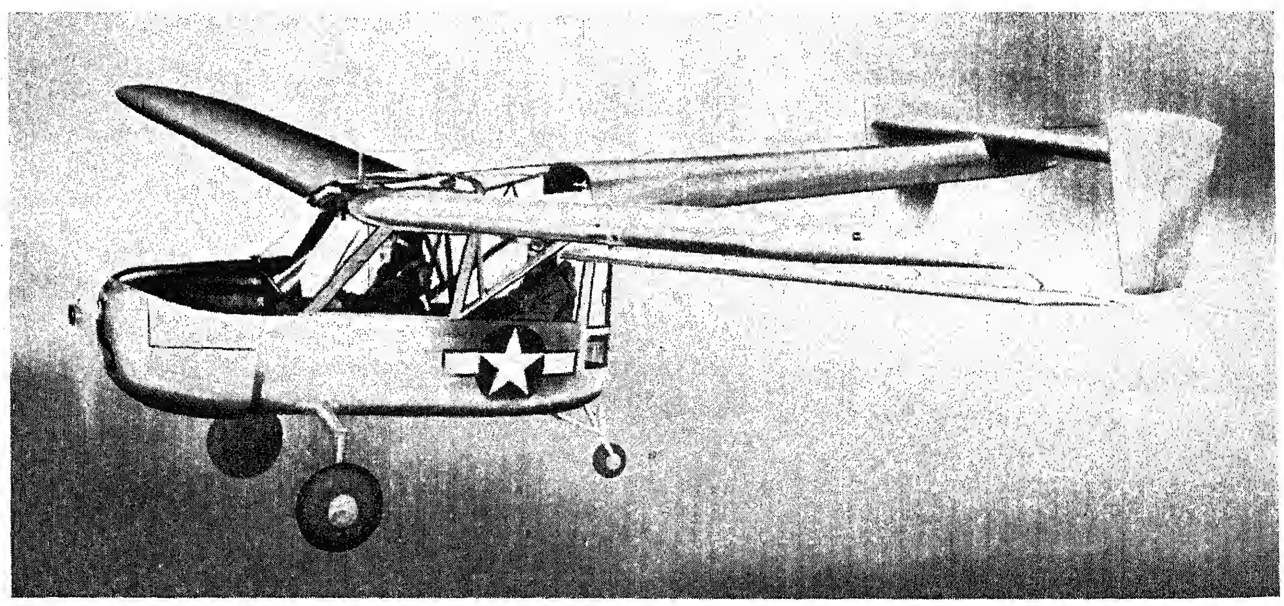
The L-15A has full-span aerofoil-section flaps suspended below the trailing-edge of the wings. These flaps, which have a movement ranging from 10° up to 40° down, act differentially in conjunction with the operation of spoiler-type ailerons. The power-plant consists of a 125 h.p. Lycoming horizontally-opposed air-cooled engine.

The L-15A is in production for use by the U.S. Army Ground Forces at the Wichita Division of the Boeing company.

DIMENSIONS.—Span 40 ft. (12.2 m.), Length 26 ft. 1 in. (7.95 m.), Height 8 ft. 8½ in. (2.65 m.).

LOADED WEIGHT.—2,050 lbs. (931 kg.).

PERFORMANCE.—Maximum speed 112 m.p.h. (179.2 km.h.), Cruising speed 101 m.p.h. (161.6 km.h.), Minimum flying speed 50 m.p.h. (80 km.h.), Initial rate of climb 628 ft./min. (191.5 m./min.), Service ceiling 16,400 ft. (5,000 m.), Take-off run over 50 ft. (15.25 m.) obstacle 600 ft. (183 m.), Landing run over 50 ft. (15.25 m.) obstacle 517 ft. (158 m.), Normal endurance 2½ hours, Maximum endurance (with external auxiliary fuel tank) 5½ hours.



The Boeing XL-15, prototype of the L-15A Two-seat Liaison Monoplane (125 h.p. Lycoming engine).

BUNYARD.

BUNYARD AIRCRAFT COMPANY.

FLUSHING, LONG ISLAND, N.Y.

Mr. Kenneth Bunyard produced his first aircraft, at Westchester, N.Y., in 1931. This was a small biplane flying-boat with a span of 16 ft. 0 in. (4.88 m.), and powered by a 15 h.p. Johnson outboard motor. His second design, which did not advance beyond the mock-up stage, was an amphibian consisting of a monocoque landplane fuselage which could be attached to a flying-boat hull.

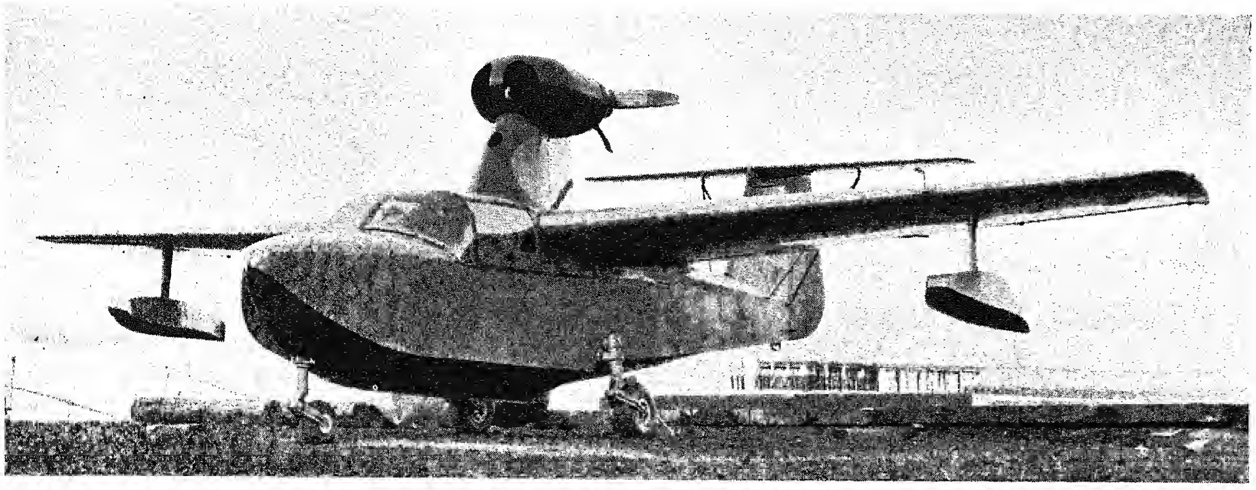
The latest Bunyard design is a light wooden amphibian flying-boat known as the Sportsman. This aircraft was designed in the first instance as a liaison and ambulance amphibian for the U.S. Navy, but has since been adapted to private owners' requirements. The prototype aircraft is powered by a 130 h.p. Franklin engine, but the production aircraft will be equipped with a 150 h.p. power plant. A specification of the Sportsman, which has received A.T.C. is given hereafter.

A four-seat version is designated the BAX-4.

THE BUNYARD BAX-3 SPORTSMAN.

TYPE.—Three-seat light Amphibian Flying-boat.

WINGS.—Cantilever high-wing monoplane. Spruce structure with single wide main spar, false spar carrying control surfaces, and ⅛ in. (3.16 m/m.) mahogany plywood skin. Entire trailing-edge hinged on self-aligning ball-bearings, outer sections acting as ailerons and inner sections as flaps.



The Bunyard BAX-3 Sportsman Three-seat Boat Amphibian (130 h.p. Franklin engine).—(*Martin & Kelman*).

HULL.—Single-step structure with spruce frames and built-up spruce and plywood bulkheads. Outer keel on forward section of oak sheathed in stainless-steel. Upper chine of box-type construction running from nose-wheel to aft of rear spar attachment, and of solid spruce aft to rudder post. Covering of flat plywood sheets. Stabilising float carried on single cantilever strut under each outer wing.

TAIL UNIT.—Strut-braced monoplane type. Tailplane and elevators carried at top of fin and rudder. Tailplane span 12 ft. 11 in. (3.95 m.).

LANDING GEAR.—Retractable tricycle type of Firestone Super-flex design. Main wheels, carried on shock-absorber legs attached to sides of hull, swing upwards to lie partly within wing. Nose-wheel retracts vertically into well in bottom of hull. Wheel units detachable. Track 5 ft. 10 in. (1.78 m.).

POWER PLANT.—One 130 h.p. Franklin six-cylinder horizontally-opposed air-cooled engine mounted as pusher unit on faired steel-tube tripod above hull, and driving Sensenich two-blade two-position propeller. Completely removable engine cowling, and detachable panels on tripod. 34 U.S. gallon (133 litre) fuel tank contained within tripod.

ACCOMMODATION.—Span 34 ft. 4 in. (10.46 m.), Length 23 ft. 0 in. (7.01 m.), Height 9 ft. 0 in. (2.74 m.).

WEIGHT LOADED.—2,250 lbs. (1,009 kg.).

PERFORMANCE.—Cruising speed 105 m.p.h. (169 km.h.), Landing speed (with flaps) 48 m.p.h. (77 km.h.), (without flaps) 55 m.p.h. (88 km.h.), Rate of climb 540 ft./min. (165 m./min.), Take-off run from water 250 yds. (228 m.), (from land) 167 yds. (153 m.).

THE BUNYARD BAX-4.

The BAX-4 is a four-seat version of the BAX-3 and is powered by a 190 h.p. Lycoming O-435-A six-cylinder horizontally-opposed or a Ranger 6-440-C-5 six-cylinder in-line inverted air-cooled engine driving a Sensenich two-blade adjustable-pitch wooden or metal propeller. The enclosed cabin seats four in two pairs and there is a baggage compartment aft of the cabin with an allowance of 75 lbs. (34 kg.).

DIMENSIONS.—As BAX-3 except length 24 ft. (7.32 m.).

WEIGHTS AND LOADINGS.—Weight empty 1,695 lbs. (769 kg.), Payload 755 lbs. (342 kg.), Weight loaded 2,750 lbs. (1,247 kg.), Wing loading 14.7 lbs./sq. ft. (71.8 kg./sq. m.), Power loading 14.45 lbs./h.p. (6.54 kg./h.p.).

PERFORMANCE.—Maximum speed 133 m.p.h. (214 km.h.), Cruising speed 118 m.p.h. (190 km.h.), Landing speed 64.5 m.p.h. (104 km.h.), Stalling speed 57.8 m.p.h. (93 km.h.), Initial rate of climb 590 ft./min. (180 m./min.), Service ceiling 9,500 ft. (2,895 m.), Cruising range 680 miles (1,094 km.), Take-off run (from land) 317 yds. (290 m.), Take-off run (from water) 315 yds. (288 m.), Landing run 250 yds. (228 m.), Alighting run 167 yds. (153 m.), Fuel consumption (Lycoming engine—75% power) 11.8 U.S. gallons/hr. (44.6 litres/hr.), (Ranger engine—full power) 19.6 U.S. gallons/hr. (74 litres/hr).

CALL.

CALL AIRCRAFT COMPANY.

HEAD OFFICE AND WORKS: AFTON, WYO.
General Manager: Reuel Call.
Chief Engineer: Ivan Call.
Acting Chief Engineer: Spencer Call.

This Company has developed the Call-Air two-seat light monoplane powered by a 125 h.p. Lycoming engine. Details of the latest version, the Model A2, are given hereafter. This aircraft has been awarded its Approved Type Certificate.

THE CALL-AIR MODEL A2.

TYPE.—Two-seat Cabin monoplane.

WINGS.—Braced low-wing monoplane. Constant-chord structure with wooden spars and ribs, metal-covered leading-edge and fabric covering aft. Steel-tube inverted V-struts on each side of fuselage. Ailerons and split flaps of wooden construction with fabric covering. Wing area 181.6 sq. ft. (16.8 sq. m.).

FUSELAGE.—Steel-tube structure with fabric covering.

TAIL UNIT.—Wire-braced monoplane type. Metal framework with fabric covering. Controllable trim-tabs in rudder and starboard elevator.

LANDING GEAR.—Fixed two-wheel type. Wheels carried on faired V structures with oleo shock-absorber legs attached to front spar. Firestone hydraulic brakes, wheels and tyres. Scott steerable tail-wheel. Combined wheel/ski undercarriage optional.

POWER PLANT.—Lycoming O-290B or C four-cylinder horizontally-opposed air-cooled engine developing 125 h.p. at 2,600 r.p.m. and driving Sensenich two-blade fixed-pitch wooden airscrew. Fuel capacity 30 U.S. gallons (114 litres).

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Seat 3 ft. 7 in. (1.09 m.) wide. Plexiglas windshield. Access door on each side. Baggage compartment of 6 cub. ft. (0.17 cub. m.) capacity aft of seats; allowance 50 lbs. (22.7 kg.).

DIMENSIONS.—35 ft. 9⅜ in. (10.91 m.), Length 23 ft. 5⅝ in. (7.15 m.), Height (over cabin, tail up) 6 ft. (1.83 m.).

WEIGHTS AND LOADINGS.—Weight empty 975 lbs. (442 kg.), Disposable load 575 lbs. (261 kg.), Weight loaded 1,550 lbs. (703 kg.), Wing loading 8.53 lbs./sq. ft. (41.6 kg./sq. m.), Power loading 12.4 lbs./h.p. (5.6 kg./h.p.).

PERFORMANCE.—Maximum speed 112 m.p.h. (180 km.h.), Cruising speed 102 m.p.h. (164 km.h.), Landing speed 42 m.p.h. (68 km.h.), Initial rate of climb 1,000 ft./min. (305 m./min.), Service ceiling 17,500 ft. (5,335 m.), Cruising range 332 miles (534 km.), Take-off run 142 yds. (130 m.), Landing run 100 yds. (91 m.), Fuel consumption 8 U.S. gallons/hr. (30.3 litres/hr.).

The Call-Air Model A2 Two-seat Light Monoplane (125 h.p. Lycoming engine).

CESSNA.

The Cessna 140 Two-seat Cabin Monoplane (85 h.p. Continental engine).

CESSNA AIRCRAFT COMPANY, INC.

HEAD OFFICE AND WORKS : WICHITA, KANSAS.
Established : August 22, 1927.
President and General Manager : Dwane L. Wallace.
Vice-President and Chief Engineer : Tom Salter.
Secretary and Treasurer : Frank Boettger.
Sales Manager : Don Flower.
Service Manager : A. E. Kangas.
Director, Public Relations : Duane I. Travis.

The Cesssna Aircraft Company was engaged between 1940 and 1945 in the production of various military versions of their pre-war T-50 commercial monoplane. A variation of this aircraft, known as the Crane, was produced for crew-training duties with the Royal Canadian Air Force, and others designated AT-8 and AT-17 Bobcat were produced for the U.S. Army. A U.S. Navy light utility version was known as the JRC-1. Over 5,000 AT-17s were produced between 1940-1942, and aircraft of this type on the production line were from January 1, 1943, slightly modified and re-designated the UC-78. The Cessna company delivered more twin-engined bomber-trainers to the U.S. and Canadian Governments than all other American manufacturers combined. This series of aircraft was described and illustrated in the 1945-46 issue of this Annual. They are no longer in production.

Since 1944 Cessna was also producing component parts for the Boeing B-29 Superfortress and the Douglas A-26 Invader at both the Wichita and the former Hutchinson plants.

The Company has now designed a new two-seat enclosed high-wing monoplane for civilian use, which is produced in two versions—the Model 120 and the Model 140, both of which are powered by an 85 h.p. Continental four-cylinder horizontally opposed engine. The company also has under development two four-seat high-wing cabin monoplanes, the 170 and the 190, which were expected to be completed in 1947.

THE CESSNA MODEL 120.

TYPE.—Two-seat Cabin monoplane.

WINGS.—Strut-braced high-wing monoplane. Two-spar constant-chord structure of 24ST aluminium-alloy in two main sections. Detachable tips in two sections each side. All-metal spars, ribs and leading-edge, with fabric covering. Wing braced to fuselage by steel-tube V-struts each side. Wing chord 6 ft. $0\frac{1}{2}$ in. (1.84 m.), mean aerodynamic chord 4 ft. 11.02 in. (1.50 m.), gross wing area 159.3 sq. ft. (14.80 sq. m.). All-metal ailerons with metal covering. Aileron span 6 ft. 2 in. (1.88 m.), chord 1 ft. 2 in. (0.35 m.).

FUSELAGE.—Monocoque structure of 24ST aluminium-alloy.

TAIL UNIT.—Cantilever monoplane type. Metal structure with metal covering over all surfaces. Tailplane span 8 ft. 10 in. (2.69 m.). Trim-tab in starboard elevator.

LANDING GEAR.—Fixed two-wheel type of Cessna patent consisting of two flexing steel cantilever legs carrying wheels. Hydraulic friction-disc brakes. Track 6 ft. 5 in. (1.96 m.). Scott steerable tail-wheel. Alternatively twin Edo Model 1650 floats may be fitted.

POWER PLANT.—One 85 h.p. Continental C85-12 four-cylinder horizontally-opposed air-cooled engine driving Sensenich two-blade fixed-pitch wooden airscrew. Fuel capacity 25 U.S. gallons (94 litres) in two tanks, one in each wing root.

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Entry doors on both sides. Baggage compartment behind seats ; allowance 80 lbs. (36 kg.).

DIMENSIONS.—Span 32 ft. 10 in. (10 m.), Length (tail up) 20 ft. $11\frac{7}{8}$ in. (6.40 m.), Height (tail down, over wing) 6 ft. $3\frac{1}{4}$ in. (1.91 m.).

WEIGHTS AND LOADINGS.—Weight empty 770 lbs. (349 kg.), Weight loaded 1,450 lbs. (658 kg.). Wing loading (fully loaded) 9.1 lbs./sq. ft. (44.43 kg./sq. m.), Power loading 17.1 lbs./h.p. (7.75 kg./h.p.).

PERFORMANCE.—Maximum speed over 120 m.p.h. (193 km.h.), Cruising speed over 100 m.p.h. (161 km.h.), Landing speed 41 m.p.h. (66 km.h.), Rate of climb at sea level 680 ft./min. (207 m./min.), Service ceiling 15,500 ft. (4,724 m.), Cruising range 450 miles (724 km.).

THE CESSNA MODEL 140.

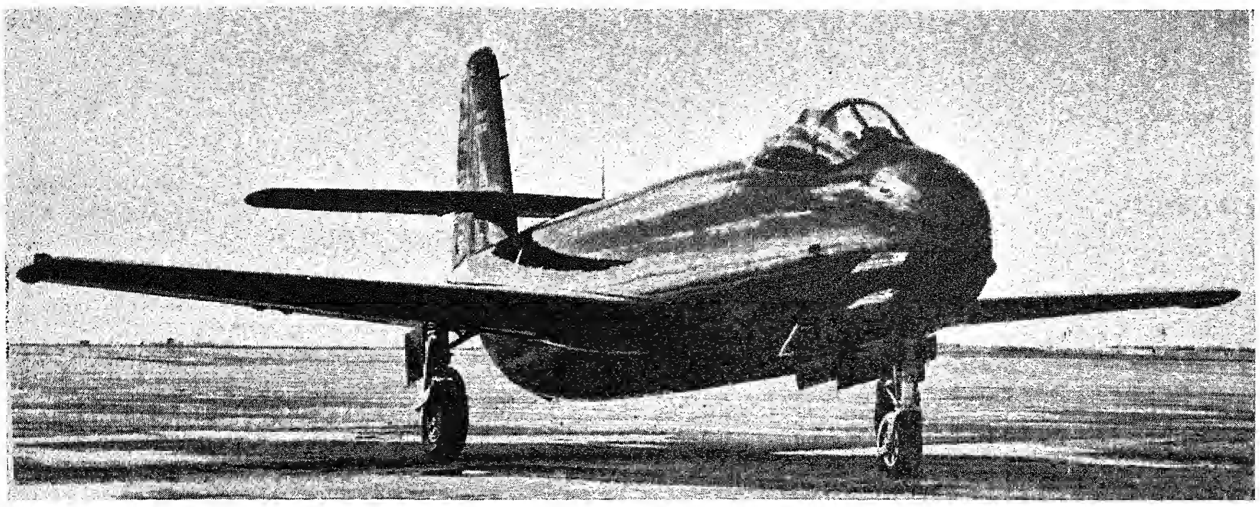
The Model 140 is identical to the Model 120 but has certain refinements including starter, generator and battery. It is also fitted with manually-operated all-metal plain-hinge flaps between ailerons and fuselage.

WEIGHTS AND LOADINGS.—As Model 120 except weight empty 890 lbs. (404 kg.).

PERFORMANCE.—As Model 120.

The Cessna 140 Two-seat Cabin Monoplane (85 h.p. Continental engine).

CHANCE VOUGHT.



The Chance Vought XF6U-1 Pirate Single-seat Fighter (one Westinghouse turbo-jet engine).

CHANCE VOUGHT AIRCRAFT DIVISION OF THE UNITED AIRCRAFT CORPORATION.

Head Office and Works: Stratford, Connecticut.
General Manager: Rex B. Beisel.
Assistant to General Manager: J. D. P. Hedapp.
Division Accountant: J. J. Gaffney.
Assistant Treasurer and Assistant Secretary: R. W. Gleason.
Engineering Manager: Paul S. Baker.
Chief Engineer: J. M. Shoemaker.
Factory Manager: B. D. Taliaferro.
Sales Manager: J. J. Hospers.
Plant Engineer and Assistant to General Manager: W. H. Espey.

In January, 1943, the Chance Vought and Sikorsky Aircraft Divisions of the former Vought-Sikorsky Division of the United Aircraft Corporation were reconstituted as separate manufacturing Divisions to enable Chance Vought to devote all its energies to the development and production of combat aircraft, while the Sikorsky Division concentrates on the development of the helicopter.

During 1944-45 Chance Vought production was devoted entirely to the F4U Corsair fleet fighter for the U.S. Navy and the Royal Navy. When the Japanese surrendered the Division had completed 6,600 Corsairs and a further 4,700 had been built by the Goodyear Aircraft Corporation and the Brewster Aeronautical Corporation. In August, 1945, the Corsair was being delivered at the rate of 300 a month. More than 13,000 Chance Vought-designed aircraft were delivered during the period between the Spring of 1940 and VJ Day.

The latest version of the Corsair is the F4U-4, which first went into production at the end of 1944, and at the time of writing was still being produced in limited quantities.

The OS2U Kingfisher (last described in the 1945-46 issue of this Annual) is no longer in production but was still in use at the end of 1945.

Chance Vought developed during the war a new light material known as Metalite, which consists of thin sheets of high-strength aluminium-alloy separated by a thick low-density balsa core, the whole being bonded together into one unit. Metalite has been employed in the construction of Corsair tailplanes, and is to be used on the new Chance Vought designs being developed.

THE CHANCE VOUGHT PIRATE.

U.S. Navy designation: XF6U-1.

The XF6U-1 is a single-seat jet-propelled fighter which has been developed for the U.S. Navy. It is undergoing its preliminary flying trials at the U.S. Army test base at Muroc, Cal., where it made its first flight on October 2, 1946. It was transported from Stratford to Muroc in a Fairchild C-82A Packet.

It is a low-wing cantilever monoplane fitted with a single Westinghouse axial-flow jet unit mounted in the fuselage amidships and exhausting beneath the rear end of the fuselage. The air intakes are in the leading-edge of the wing roots.

The aircraft is built of a new material developed by Chance Vought and called Metalite. This is a sandwich of two thin sheets of high-strength aluminium-alloy enclosing a balsa wood core.

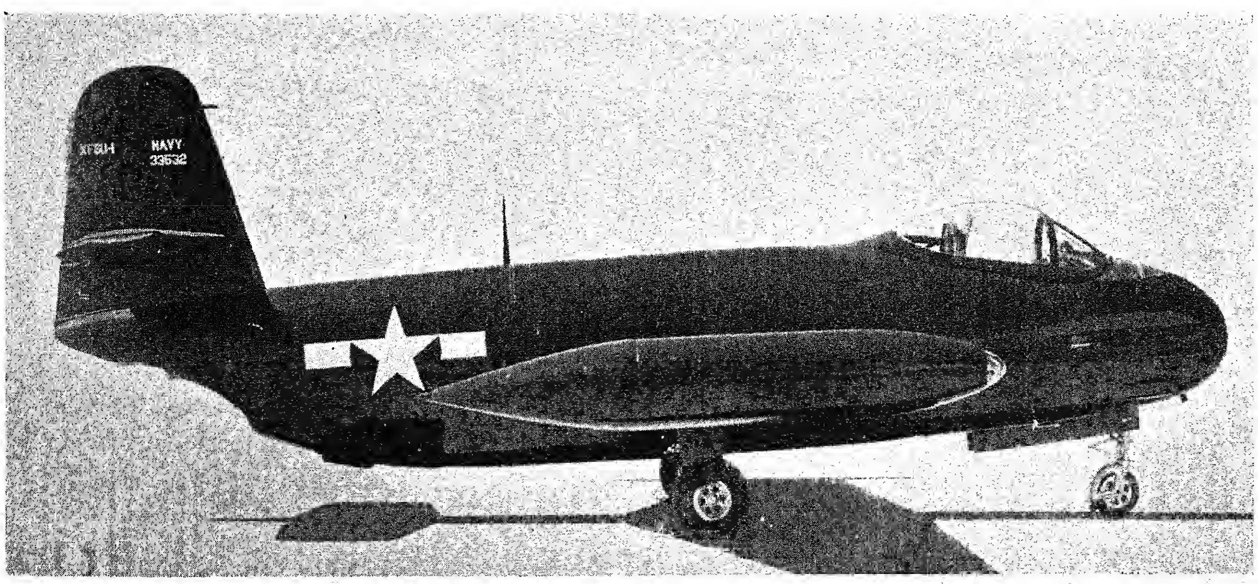
The XF6U-1 has a tricycle landing-gear and may be fitted with auxiliary droppable wing tanks. The armament consists of six 0.5 in. (12.7 m/m.) machine-guns grouped in the nose of the fuselage.

No further details are available for publication.

THE CHANCE VOUGHT XF5U-1.

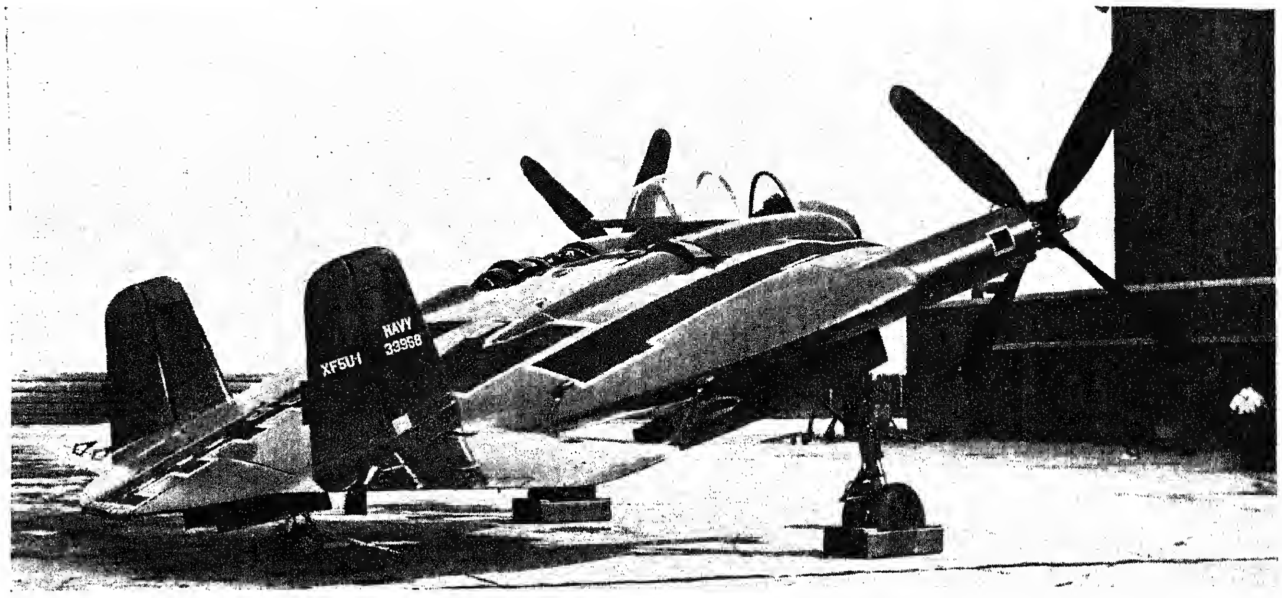
The XF5U-1 is an experimental aircraft consisting of a wing of roughly circular plan form which constitutes the main structure. It is powered by two 1,350 h.p. Pratt & Whitney R-2000 Twin Wasp engines buried in the wing, one on either side of the cockpit, which drive Hamilton Standard four-blade tractor airscrews mounted at the extremities of the wing through a right-angle transmission with a reduction gearing of approximately 5 : 1. Special clutches permit either engine to drive both airscrews in emergency.

The airscrews are specially developed for this aircraft, and have articulated blades similar to those used on a helicopter,



The Chance Vought XF6U-1 Pirate Single-seat Fighter (one Westinghouse turbo-jet engine).

CHANCE VOUGHT—*continued.*



The Chance Vought XF5U-1 Experimental Fighter (two 1,350 h.p. Pratt & Whitney R-2000 Twin-Wasp engines).

so that at high angles of attack the blades move forward at constant pitch and flatten out as they speed aft, thus making it possible for the aircraft to hover at low or zero speeds.

The purpose of the design is to provide an aircraft with a wide speed range, and landing and maximum speeds of 40 m.p.h. (64 km.h.) and 425 m.p.h. (684 km.h.) respectively are estimated. By using engines with water injection the speed range is expected to be 20-460 m.p.h. (32-740 km.h.), and with turbine-driven airscrews 0-550 m.p.h. (0-885 km.h.). The low or zero forward speeds will be obtained by standing the aircraft on its tail and hovering on its airscrews. The lower the forward speed the greater the power which will be needed, 0 m.p.h. requiring the greatest power.

Controls of the XF5U consist of twin fins and rudders mounted at the trailing-edge of the wing, and swept-back horizontal surfaces fixed outboard of the vertical surfaces comprising tailplane and elevators. Differential movement of the elevators provides lateral control. A retractable tricycle landing-gear is fitted.

A low-powered full-scale version of the XF5U-1 of wood and fabric construction, known as the V-173, first flew in 1942. Test flights of the XF5U were scheduled for 1947.

THE CHANCE VOUGHT CORSAIR

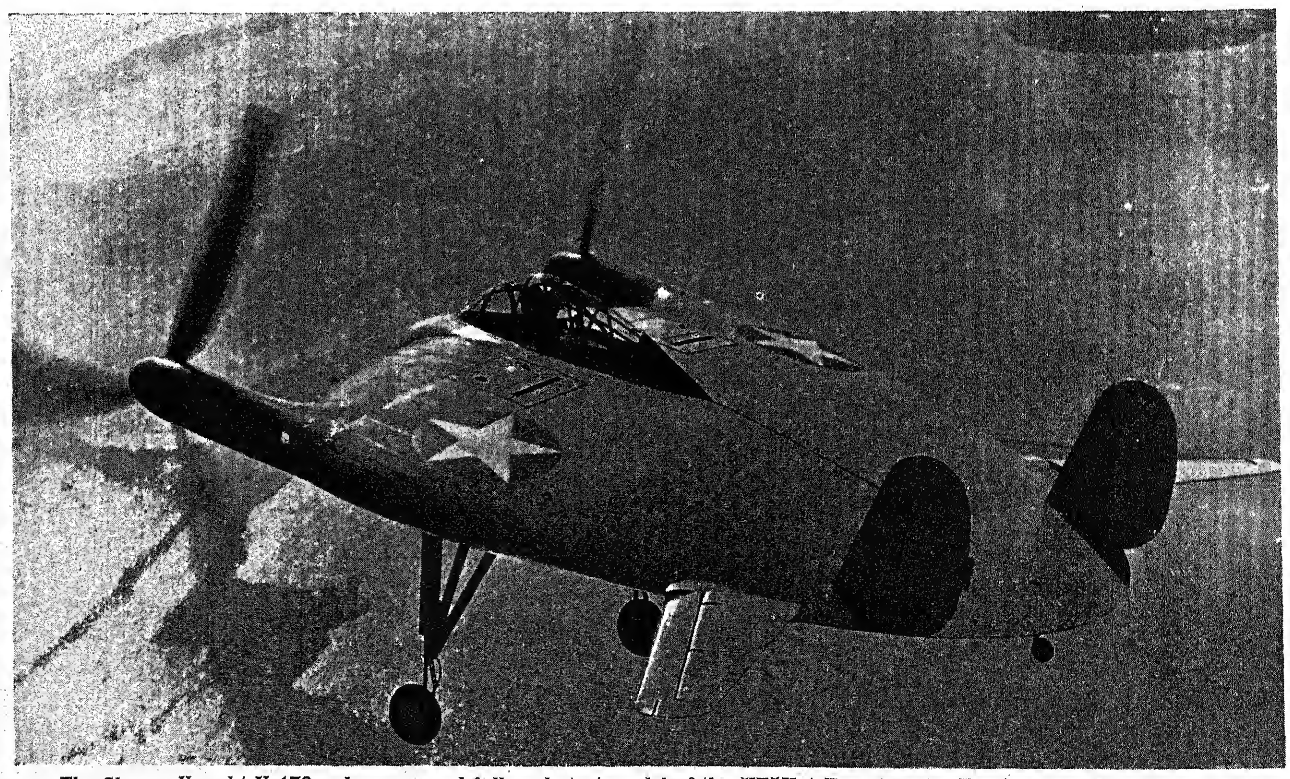
U.S Navy designation : F4U.

The prototype XF4U-1 was delivered to the U.S. Navy in 1940 and after protracted tests the Corsair was ordered in quantity in the Autumn of 1941. The first production F4U-1 flew in June, 1942.

Up to the end of 1944 the Corsair had been used exclusively by the U.S. Navy and Marine Corps as a land-based fighter in the Pacific, being first reported in action in the Solomon Islands area on February 15, 1943. In 1945, the Corsair was assigned to U.S. aircraft-carriers.

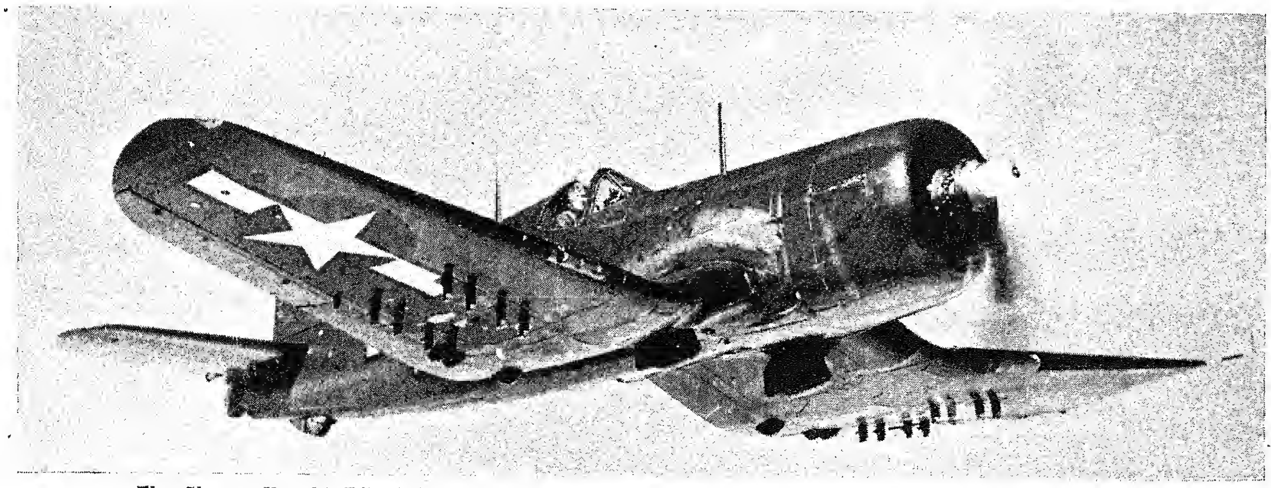
Since the first deliveries of the F4U-1 over 500 major and 2,500 minor engineering and production changes were made in this aircraft, the version known as the F4U-1D being fitted with clipped wings, a twin-pylon rack under the fuselage for carrying two 1,000 lb. (454 kg.) bombs or auxiliary fuel tanks, a new clear-view sliding hood, night-fighting and rocket-projectile equipment, water injection, etc.

The XF4U-3 was an experimental version of the Corsair powered by a Pratt & Whitney R-2800-16 Double-Wasp engine in combination with a turbo-supercharger. Air for the supercharger is drawn in through a scoop under the engine accessory compartment. The XF4U-3 had an operational ceiling above 40,000 ft. (12,190 m.) with increased speed and manœvrability.



The Chance Vought V-173, a low-powered full-scale test model of the XF5U-1 Experimental Fighter, which flew in 1942.

CHANCE VOUGHT—*continued.*



The Chance Vought F4U-4 Corsair Single-seat Naval Fighter (Pratt & Whitney R-2800-18W engine).

The F4U-4 was the last version of the Corsair used by the U.S. Navy in combat and at the time of writing was still being delivered to the U.S. Navy in small numbers.

The XF4U-5 is similar to the F4U-4 but is fitted with the Pratt & Whitney R-2800-32W engine with two-stage blower.

The specification which follows refers to the standard F4U-4.

Type.—Single-seat Fighter.

Wings.—Cantilever low-wing monoplane. All-metal single-spar structure in three main sections consisting of inverted gull centre-section and two outer planes at acute dihedral angle. Spot-welded metal skin. Centre-section spar is integral with centre portion of fuselage. Outer wings fold upwards hydraulically for stowage. Metal ailerons with metal covering. All-metal split trailing-edge flaps between ailerons and fuselage. Gross wing area 314 sq. ft. (29.2 sq. m.).

Fuselage.—All-metal monocoque structure in four main sections :— engine section ; centre-section with main spar ; cockpit section, and rear fuselage. Spot-welded metal skin.

Tail Unit.—Cantilever monoplane type, structurally similar to wings, with spot-welded metal skin over fin, Metalite skin on tailplane and fabric-covering over movable surfaces. Balanced rudder with controllable trim-tab. Balance and trim-tabs in elevators.

Landing Gear.—Retractable two-wheel type. Wheels turn through 90 degrees as they retract backwards so as to lie flat within wings. Tail-wheel with deck arrester hook attached retracts backwards into fuselage. Hydraulic operation.

Power Plant.—One 2,100 h.p. Pratt & Whitney R-2800-18W Double Wasp eighteen-cylinder two-row radial air-cooled engine employing water injection and driving a Hamilton Standard Hydromatic four-blade constant-speed airscrew. Electric starter. Fuel tanks in wings with capacity for 225 U.S. gallons (850 litres). Two auxiliary drop tanks (total 300 U.S. gallons = 1,135 litres) may be carried under centre-section.

Accommodation.—Pilot's cockpit has bulged enclosure which slides backwards for access. Bullet-resisting windscreen and armour-plate protection.

Armament.—Six .5-in. (12.7 m/m.) guns, three in each outer wing, or four 20 m/m. cannon (F4U-4C), two in each outer wing, outboard of airscrew disc. Racks below wings for eight 5-in. (12.7 c/m.) rocket projectiles, or two 1,000 lb. (454 kg.) or 1,600 lb. (726 kg.) bombs under fuselage. Special radar (F4U-4E) or special night fighting equipment (F4U-4N) may be installed.

Dimensions.—Span 40 ft. 11¾ in. (12.48 m.), Span (folded) 17 ft. 0 in. (5.18 m.), Length 33 ft. 8¼ in. (10.27 m.), Height (tail down) 14 ft. 9¼ in. (4.49 m.), Height (folded) 16 ft. 4¼ in. (4.98 m.).

Weights and Loadings.—Weight empty 9,336 lbs. (4,238 kg.), Normal loaded weight 12,526 lbs. (5,686 kg.), Wing loading 39.9 lbs./sq. ft. (194.7 kg./sq. m.), Power loading 5.9 lbs./h.p. (2.67 kg./h.p.).

Performance.—Maximum speed 425 m.p.h. (680 km.h.) at 23,000 ft. (7,020 m.), Stalling speed 89 m.p.h. (142.4 km.h.), Initial rate of climb 3,340 ft./min. (1,020 m./min.), Climb to 10,000 ft. (3,050 m.) 3.2 min., Climb to 20,000 ft. (6,100 m.) 6.8 min., Service ceiling 41,600 ft. (12,670 m.), Normal cruising range 1,120 miles (1,790 km.), Maximum ferrying range 1,620 miles (2,590 km.).

The Experimental Chance Vought XF4U-3 Corsair with a Pratt & Whitney R-2800-16 engine and turbo-supercharger.

COLUMBIA.

COLUMBIA AIRCRAFT CORPORATION (Division of Commonwealth Aircraft, Inc.).

Head Office : 521, Fifth Avenue, New York 17, N.Y.

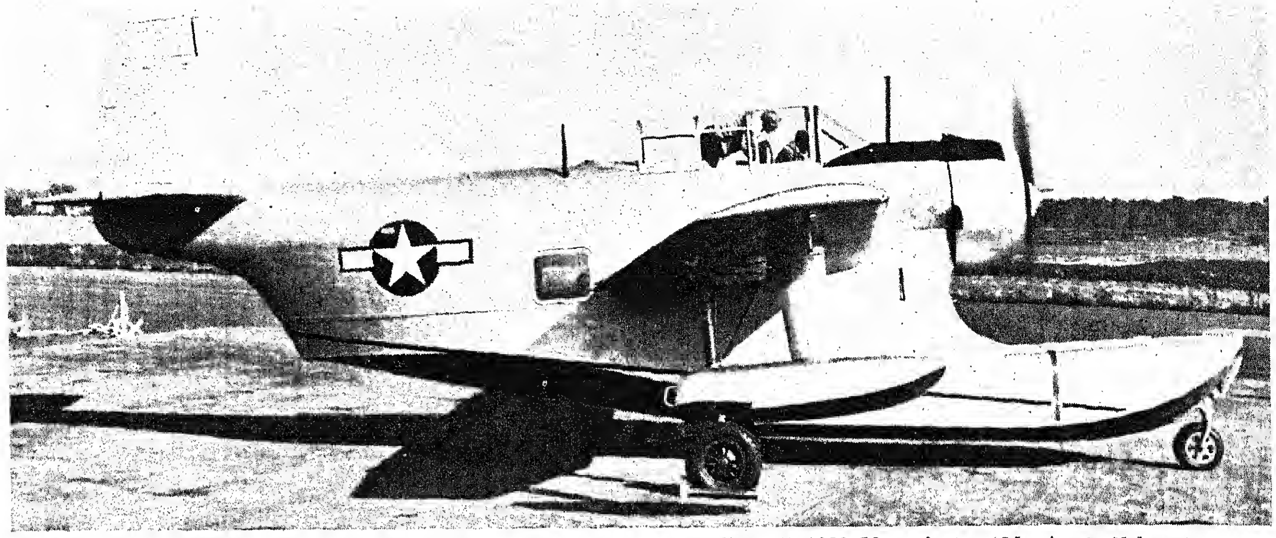
Works : Valley Stream, Long Island, N.Y.

Officials : See "Commonwealth."

The Columbia Aircraft Corpn. was acquired by Commonwealth Aircraft, Inc. early in 1946 but in spite of the fact that the Valley Stream plant has been tooled up for the production of the Commonwealth Skyranger, the Columbia division still retains its former identity and continues with the development of projects undertaken prior to its acquisition by Commonwealth.

During the war the Columbia Aircraft Corpn. produced the J2F-6 Duck general utility amphibian under licence from the Grumman Aircraft Engineering Corpn. for the U.S. Navy. It also undertook the development of a replacement of the J2F

***COLUMBIA**—continued.*



The Columbia XJL-1 General Utility Amphibian (Pratt & Whitney R-1820-56 engine).—(*Martin & Kelman*).

under the designation XJL and production of the prototype XJL-1 was not interrupted when Commonwealth took over the Valley Stream plant. The aircraft was completed late in 1946.

THE COLUMBIA XJL-1.

TYPE.—Single-engined General Utility boat amphibian.

WINGS.—Mid-wing cantilever monoplane. Wide centre-section, equal to half span, of constant-chord and thickness. Tapering outer sections, with straight leading-edge, hinge upwards for stowage. All-metal structure. Flaps on centre-section, ailerons on outer sections. Total wing area 413 sq. ft. (38.4 sq. m.).

HULL.—Deep straight-sided hull of two-step type and with nose of hull extending forward beneath engine and airscrew. All-metal structure. Fixed all-metal stabilising floats under outer wing sections.

TAIL UNIT.—Cantilever monoplane type. Fin integral with hull structure. All-metal tailplane. Metal-framed fabric-covered elevators and rudder. Trim-tabs in all movable surfaces.

LANDING GEAR.—Retractable tricycle type. Main wheels raised inwardly into undersides of centre-section, nose wheel backwards into nose of hull. Hydraulic suspension and retraction. Catapult points. Arrester hook hinged at rear step. Track of main wheels 22 ft. 2 in. (6.75 m.).

POWER PLANT.—One Wright R-1820-56 nine-cylinder radial air-cooled engine driving a Hamilton Standard Hydromatic three-blade airscrew.

ACCOMMODATION.—Tandem cockpits under continuous canopy. Access from rear cockpit to lower compartment for photographic, target-towing or rescue work. As personnel transport there is accommodation for six.

DIMENSIONS.—Span 50 ft. (15.25 m.), Width folded 27 ft. 2 in. (8.28 m.), Length 45 ft. 11 in. (14 m.), Height 16 ft. (4.8 m.), Height folded 17 ft. (5.2 m.).

WEIGHTS AND PERFORMANCE.—No data available.

COMMONWEALTH.

COMMONWEALTH AIRCRAFT, INC.

GENERAL OFFICES: 521, FIFTH AVENUE, NEW YORK 17, N.Y.
WORKS: VALLEY STREAM AND PORT WASHINGTON, LONG ISLAND, NEW YORK.

President and General Manager: Raymond Voyes.
Vice-President: Benjamin S. Dowd.
Director of Sales and Public Relations: John E. Cregier, Jr.

Commonwealth Aircraft, Inc., came into being in October, 1942, when Rearwin Aircraft and Engines, Inc., of Kansas City, Kansas, was acquired by New York interests headed by Mr. Charles H. Dolan and was reconstituted under its new name.

The original Rearwin Company was formed in May, 1929, and was operated as a partnership by R. A. Rearwin, Royce S. Rearwin and Kenneth R. Rearwin. In December, 1937, Rearwin Airplanes bought the assets, including patents, machinery, fixtures, patterns, etc., of the Le Blond Aircraft Corporation of Cincinatti, Ohio, and the name of the concern was changed to Rearwin Aircraft and Engines Inc., the engines being marketed under the trade name of Ken-Royce. The products of the Rearwin and Le Blond companies and of Rearwin Aircraft and Engines, Inc., have been fully described in earlier editions of this Annual.

During 1944 and up to VJ-Day, Commonwealth Aircraft, Inc., was engaged in the production of Waco CG-3A and CG-4A troop-carrying gliders for the U.S. Army Air Forces. Commonwealth was the second largest producer of gliders and fulfilled orders totalling $41,000,000. In addition, the company manufactured hydraulic components and various sub-assemblies for other aircraft manufacturers.

In 1945, Commonwealth acquired the manufacturing rights of the Trimmer twin-engined boat amphibian from the Allied Aviation Corpn. The company is also engaged on the development of several other post-war aircraft, one of which will be an enlarged version of the Trimmer with increased power and capacity. Also in production is the Model 185 Skyranger two-seat cabin monoplane, an improved version of the former Rearwin Model 175 Skyranger which was in production by Rearwin up to America's entry into the war.

Early in 1946 Commonwealth Aircraft acquired the complete assets of the Columbia Aircraft Corporation of Valley Stream, Long Island, New York. With this acquisition all manufacturing activities were transferred from Kansas City to the Valley Stream plant. During the war, Columbia produced the Grumman J2F-6 Duck single-engined amphibian for the U.S. Navy. It also undertook the development of a new type of General Utility amphibian under the designation XJL. For details of this aircraft see under "Columbia" above.

In March, 1946, Commonwealth acquired the Cairn Manufacturing Company, makers of aluminium luggage, lawn furniture and canoes. These activities will be concentrated elsewhere, and the plant at Port Washington will be used for the manufacture of the Trimmer amphibian, which is scheduled to be produced at the rate of twenty-five a day by July, 1946.

THE COMMONWEALTH MODEL 185 SKYRANGER.

TYPE.—Two-seat Light Cabin Monoplane.

WINGS.—Strut-braced high-wing monoplane. Two-spar structure made in two constant-chord sections attached directly to sides of fuselage. Solid spruce spars laminated at strut attachment points and with bushings at all bolt holes. Spruce truss-type ribs with plywood gussets pressed in place. Leading and trailing-edges of sheet duralumin, with steel-tube curved cap strip. Fabric covering. Steel tie-rods and torsion bracing. Chord 5 ft. 0 in. (1.524 m.). Wing area 164.6 sq. ft. (15.29 sq. m.). Wooden ailerons with fabric covering. Aileron span 6 ft. 11.06 ins. (2.1 m.). Built-in leading-edge slots of aluminium-alloy construction, span of slots 3 ft. 4.3 in. (1.12 m.).

FUSELAGE.—Welded chrome-molybdenum steel-tube structure with four main longerons, spruce lougitudinal fairing stringers and fabric covering.

TAIL UNIT.—Wire-braced monoplane type of flat-plate section. Welded chrome-molybdenum steel-tube spars with steel channel-section ribs, and fabric covering over fixed and movable surfaces. Fin built integral with fuselage. Rudder and elevators on Oilite bearings. Rudder trim-tab adjustable on ground only. Trim tab in starboard elevator controlled by Commonwealth-type micro-adjustment mechanism in cabin roof. Elevator tab span 1 ft. $9\frac{3}{16}$ in. (.53 m.).

LANDING GEAR.—Fixed divided type, each unit consisting of a semi-cantilever hydraulic shock-absorber leg and an axle hinged to the fuselage centre-line. Wheel spats. Track 6 ft. 2 in. (1.88 m.). Wheel base (tail down) 16 ft. $1\frac{5}{16}$ in. (4.9 m.). Hydraulic brakes. Scott spring-mounted steerable tail-wheel.

POWER PLANT.—One 85 h.p. Continental C85 four-cylinder horizontally-opposed air-cooled engine driving two-blade fixed-pitch wooden airscrew, 6 ft. 6 in. (1.98 m.) diameter. Fuel capacity 24 U.S. gallons (90 litres) in two crash-resisting wing tanks.

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Entry door on each side with sliding windows.

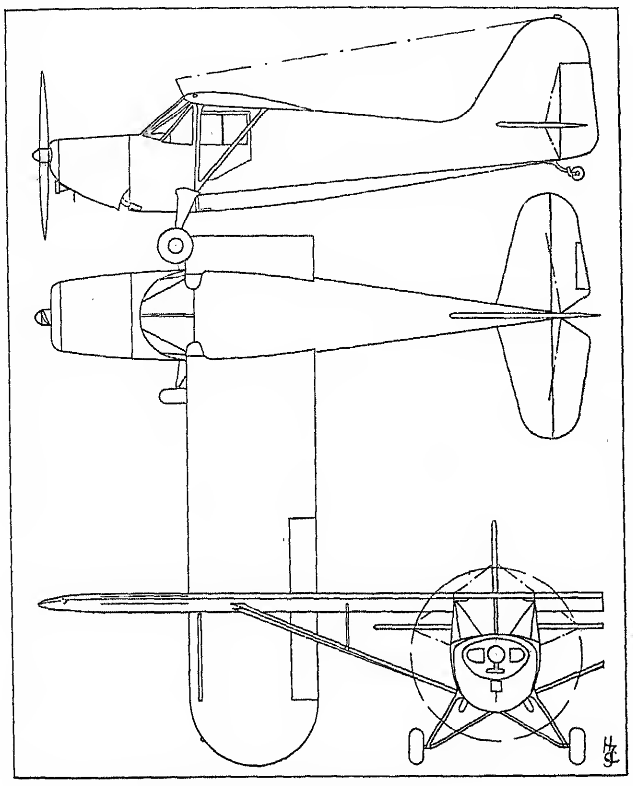
EQUIPMENT.—Special equipment, not on standard model, includes two-way radio, landing lights, blind-flying instruments and variable pitch airscrew.

DIMENSIONS.—Span 34 ft. 0 in. (10.36 m.), Length (overall) 21 ft. 9 in. (6.63 m.), Height (tail down, over wing) 6 ft. 7 in. (2 m.).

WEIGHTS AND LOADINGS.—Weight empty 910 lbs. (413 kg.), Baggage allowance 50 lbs. (22.6 kg.), Weight loaded 1,450 lbs. (658 kg.). Wing loading (fully loaded) 8.81 lbs./sq. ft. (43 kg./sq. m.), Power loading (fully loaded) 17.06 lbs./h.p. (7.7 kg./h.p.).

PERFORMANCE.—Maximum speed 114 m.p.h. (183 km.h.), Cruising speed 103 m.p.h. (166 km.h.), Landing speed 48 m.p.h. (77 km.h.),

COMMONWEALTH—*continued.*



The Commonwealth 185 Skyranger.

Rate of climb 650 ft./min. (198 m./min.), Service ceiling 14,000 ft. (4,265 m.), Normal take-off run 475 ft. (145 m.), Normal range 500 miles (805 km.).

THE COMMONWEALTH TRIMMER.

Type.—Three-seat Light Amphibian flying-boat.

Wings.—Cantilever high-wing monoplane. Aerofoil section (root) NACA 23015, (tip) NACA 23012. Two box-spar structure in three sections consisting of a constant-chord centre-section integral with hull and carrying engines and accessories, and two tapered outer sections with semi-circular tips. Centre-section has plywood covering, outer sections covered with plywood to rear spar and thereafter with fabric. Gross wing area 162.5 sq. ft. (15.09 sq. m.). Statically-balanced fabric-covered wooden ailerons on ball-bearing hinges. Aileron area (both) 16.3 sq. ft. (1.51 sq. m.), movements, up 30 degrees, down 25 degrees. Plain-hinge flaps in two pieces on centre-section, plywood structure and covering. Total flap area 13.75 sq. ft. (1.27 sq. m.). Built-in leading-edge slots on outer wings.

Hull.—Two-step structure of moulded plywood divided into three watertight compartments. Bonded phenolic paper finish. Wing-tip floats of similar construction attached to outer wings by stream-lined steel-tube struts and wire-braced.

Tail Unit.—Semi-cantilever monoplane type, with strut-braced tailplane. Fin and tailplane of wooden construction with plywood covering. Rudder of wooden construction with fabric covering. Controllable rudder trim-tab. Welded steel statically-balanced elevators with fabric covering. Controllable trim-tab in port elevator. Tailplane span 9 ft. 11⅜ in. (3.03 m.); tailplane area 14.58 sq. ft. (1.35 sq. m.); fin area 9.5 sq. ft. (.88 sq. m.); rudder area 8.75 sq. ft. (.81 sq. m.); rudder movement 30 degrees each way; elevator area (both) 11 sq. ft. (1.02 sq. m.); elevator movements up 25 degrees, down 25 degrees.

Landing Gear.—Retractable two-wheel type. Wheels carried on Electric Model 400-5 hydraulic shock-absorber struts and raised into recessed fairings on sides of hull. Electric or hydraulic operation, with emergency manual gear. Track 7 ft. 0 in. (2.13 m.). Tail-wheel on leaf spring on rear step. Goodyear single-disc hydraulic brakes with Scott hydraulic actuators.

Power Plant.—Two 85 h.p. Continental C85-12 four-cylinder horizontally-opposed air-cooled engines in centre-section on welded steel-tube rubber-mounted bearings and attached by four bolts. Cruising r.p.m. 2,300; maximum r.p.m. 2,575. Two-blade fixed pitch or constant-speed airscrews, 6 ft. 6 in. (1.98 m.) diameter. Maximum fuel capacity 40 U.S. gallons (151 litres). Oil capacity 1.25 U.S. gallons (4.5 litres) each engine. Special long-range tanks fitting into wheel fairings may replace land undercarriage.

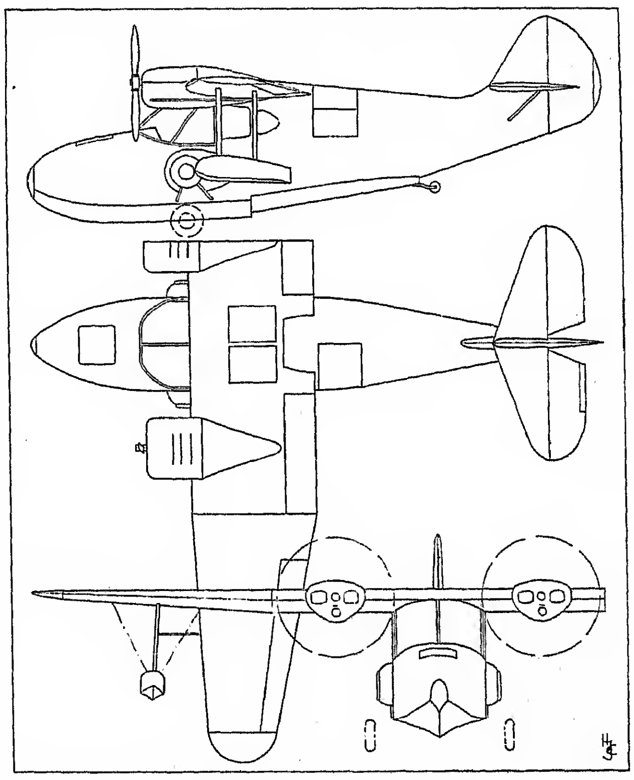
Accommodation.—Enclosed and sound-proofed cabin seating three; two side-by-side with dual controls in front, and one behind. Adjustable seats. Windows in roof above rear seat. Three seats convertible to two bunks on *de Luxe* model. Entry hatch on port side of hull aft of wing, and mooring hatch in deck forward of windscreen. Maximum cabin width 3 ft. 10 in. (1.17 m.).

Equipment.—12-volt electric system. Anchorage gear in forward watertight compartment. Two-way radio, landing lights and constant-speed airscrews on *de Luxe* model.

Dimensions.—Span 35 ft. 6 in. (10.81 m.), Length 24 ft. 9$\frac{3}{16}$ in. (7.55 m.), Height (on ground, over engines, airscrew horizontal) 7 ft. 6½ in. (2.29 m.).

Weights and Loadings.—Weight empty 1,520 lbs. (689 kg.), Weight loaded 2,200 lbs. (998 kg.), Wing loading (fully loaded) 13.4 lbs./sq. ft. (65.43 kg./sq. m.), Power loading (fully loaded) 14.7 lbs./h.p. (66.6 kg./h.p.).

Performance.—(Fully loaded, fixed pitch airscrews) Maximum speed 135 m.p.h. (217 km.h.), Cruising speed 115 m.p.h. (185 km.h.), Landing speed, with flaps. 48 m.p.h. (77 km.h.) without flaps, 57 m.p.h. (92 km.h.), Rate of climb 850 ft./min. (259 m./min.), Service ceiling 14,000 ft. (6,350 m.), One-engine ceiling 1,500 ft. (680 m.), Cruising range 500 miles (805 km.), Take-off run, with 10 degrees flap, 6 m.p.h. (9.6 km.h.) wind, (from water) 637 ft. (194 m.); (from land) 532 ft. (162 m.). Fuel consumption 9.8 U.S. gallons (37 litres) per hour.



The Commonwealth Trimmer.

CONSOLIDATED VULTEE.

THE CONSOLIDATED VULTEE AIRCRAFT CORPORATION.

Head Office: San Diego, Cal.

Works: San Diego and Vultee Field, Cal.; Forth Worth Tex.; Nashville, Tenn.; Wayne, Mich.

President: Harry Woodhead.
Executive Vice-President: I. M. Laddon.
Vice-President: C. T. Leigh.
Vice-President in charge of Finance: V. C. Schorlemmer.
Vice-President in charge of Sales: William A. Blees.
Vice-President—General Counsel: R. S. Pruitt.
Secretary and Treasurer: W. M. Shanahan.

The Consolidated Vultee Aircraft Corpn. was formed in March, 1943, by the merging of the Consolidated Aircraft Corpn. and Vultee Aircraft, Inc.

The first step towards the merger occurred in December, 1941, when Vultee Aircraft, Inc. acquired 34 per cent of the common stock of the Consolidated Aircraft Corpn. and although the final merger did not take place until March, 1943, the two concerns were linked closely in management by January, 1942.

The Consolidated Vultee Aircraft Corpn. has manufactured a wide variety of military aircraft ranging from the four-engined B-32 Dominator, B-24 Liberator and C-87 Liberator Express landplanes, the PBY Catalina twin-engined flying-boat down to the Valiant single-engined Basic Trainer.

Since the end of the War Consolidated Vultee has entered the commercial field with the Model 240, a 40-passenger twin-engined airliner over 100 of which have been ordered by several of the U.S. domestic airlines. The Model 110, the predecessor of the 240, flew in the Summer of 1946 and the single example of this type is being used for extensive flight testing as the prototype of the Model 240, the first of which is not due for delivery until the Spring of 1947.

Many military prototypes are under development, including the six-engined XB-36 and XC 99; the XB-46, a bomber with

CONSOLIDATED VULTEE—*continued.*

four TG-180 jet units; and the XL-13, a single-engined liaison monoplane designed to replace the L-5 Sentinel. The XB-36 and XB-46 are being built at Fort Worth and the XC-99 and XL-13 at San Diego.

Other military prototypes on which information has been released since the end of the war are the XP-81, the first aircraft in the United States to fly with an airscrew gas-turbine, and the XA-41, a single-engined Attack monoplane.

An order for an unspecified number of P-81 fighters was received from the U.S. Army in the Summer of 1946.

Experimental and research work on new types of military and civil aircraft, and on pilotless aircraft and guided missiles proceeds at the San Diego and Vultee Field plants of the company. At Wayne, Mich., the Stinson Division is in production with the Voyager 150 light cabin monoplane (see under "Stinson").

The Corporation expanded its interests outside the aviation field in 1946 by the acquisition of the ACF-Brill Motors Company and its wholly-owned subsidiary, the Hall-Scott Motor Car Company (California), manufacturers of motor-omnibuses, trolley coaches and specialised engines. Consolidated Vultee will manufacture omnibuses and components for these firms at its Nashville plant. The Nashville plant is also manufacturing kitchen-ranges and other durable consumer goods for The Aviation Corporation, an associated Company.

THE CONSOLIDATED VULTEE MODEL 240.

The Model 240 is the production development of the Model 110 described below. Constructionally the two models are similar, but a number of minor design and constructional changes have been incorporated in the Model 240 to improve performance and operational convenience.

The increase in speed has been accomplished by a decrease in fuselage diameter and an improvement in the shape of the engine nacelles. The oil-cooler scoops in the Model 110 have been eliminated and three-blade reversible-pitch square-tip airscrews 13 ft. 1 in. (3.9 m.) in diameter replace the normal 12 ft. 2 in. (3.7 m.) four-blade airscrews used in the Model 110. "Aspirated cooling" is used on both models and it is estimated that the use of exhaust jet augmentation will result in a speed increase of 10 m.p.h. (16 km.h.). Fuel capacity has been increased from 625 to 890 U.S. gallons (2,366 to 3,369 litres).

Passenger accommodation has been increased to 40 in the Model 240, the self-contained entrance stairway has been moved from the rear fuselage to a side position forward of the wings, the baggage compartment and buffet are also moved from aft to forward of the passenger cabin. Cabin windows have been increased in size and overhead baggage racks are now provided. Passenger and crew cabins are pressurised.

Dimensions.—Span 91 ft. 9 in. (27.98 m.), Length 73 ft. 4 in. (22.36 m.), Height (over tail) 26 ft. 11 in. (8.23 m.).

Weights.—Weight empty 22,020 lbs. (10,000 kg.), Payload (alternate conditions) 8,500-10,000 lbs. (3,860-4,540 kg.), Maximum take-off weight (alternate conditions) 36,600-39,000 lbs. (16,620-17,700 kg.).

Performance. (Estimated).—Maximum speed 342 m.p.h. (547 km.h.), at 16,000 ft. (4,880 m.). Cruising speed 302 m.p.h. (483 km.h.) at 16,000 ft. (4,880 m.), Stalling speed 84 m.p.h. (134.4 km.h.), Service ceiling 32,000 ft. (9,760 m.), Single-engine Service ceiling (36,600 =16,620 kg. loaded weight) 15,000 ft. (4,575 m.), Range 800 miles (1,280 km.).

THE CONSOLIDATED VULTEE MODEL 110.

The Model 110 was designed as a 30-passenger medium-range airliner and although the prototype was due to fly in the Summer of 1946, the Model 110 has now been superseded by the Model 240 which has been ordered in numbers by many U.S. Airlines and is expected to be ready for deliveries to begin in the Spring of 1947.

The Model 110 is a twin-engined low-wing cantilever monoplane with tricycle landing-gear and single-fin tail-unit. The two Pratt & Whitney R-2800-SC13G engines are mounted in nacelles incorporating what is known as "aspirated cooling." Air after passing through the cylinder banks enters a venturi section into which the exhaust gases are also ejected, the effect being to increase the flow of cooling air. The air/exhaust mixture in a ratio of about 5/1 is ejected via a large tail pipe forming the rear end of the nacelle. There is provision for by-passing heated air and exhaust gas into the surface leading-edges for thermal de-icing and also into a heat exchanger for cabin heating.

A novel feature of the 110 which is not incorporated in the Model 240, is the passenger entrance and exit which takes the form of a hinged companion-way under the rear fuselage near the tail-unit.

Dimensions.—Span 89 ft. (27.14 m.), Length 71 ft. (21.65 m.).

Maximum Take-off Weight.—35,970 lbs. (16,330 kg.).

Performance (Estimated).—Maximum speed 330 m.p.h. (528 km.h.), Cruising speed (70% power) 270 m.p.h. (432 km.h.), Stalling speed 79 m.p.h. (126.4 km.h.), Normal range 560 miles (896 km.).

THE CONSOLIDATED VULTEE XP-92.

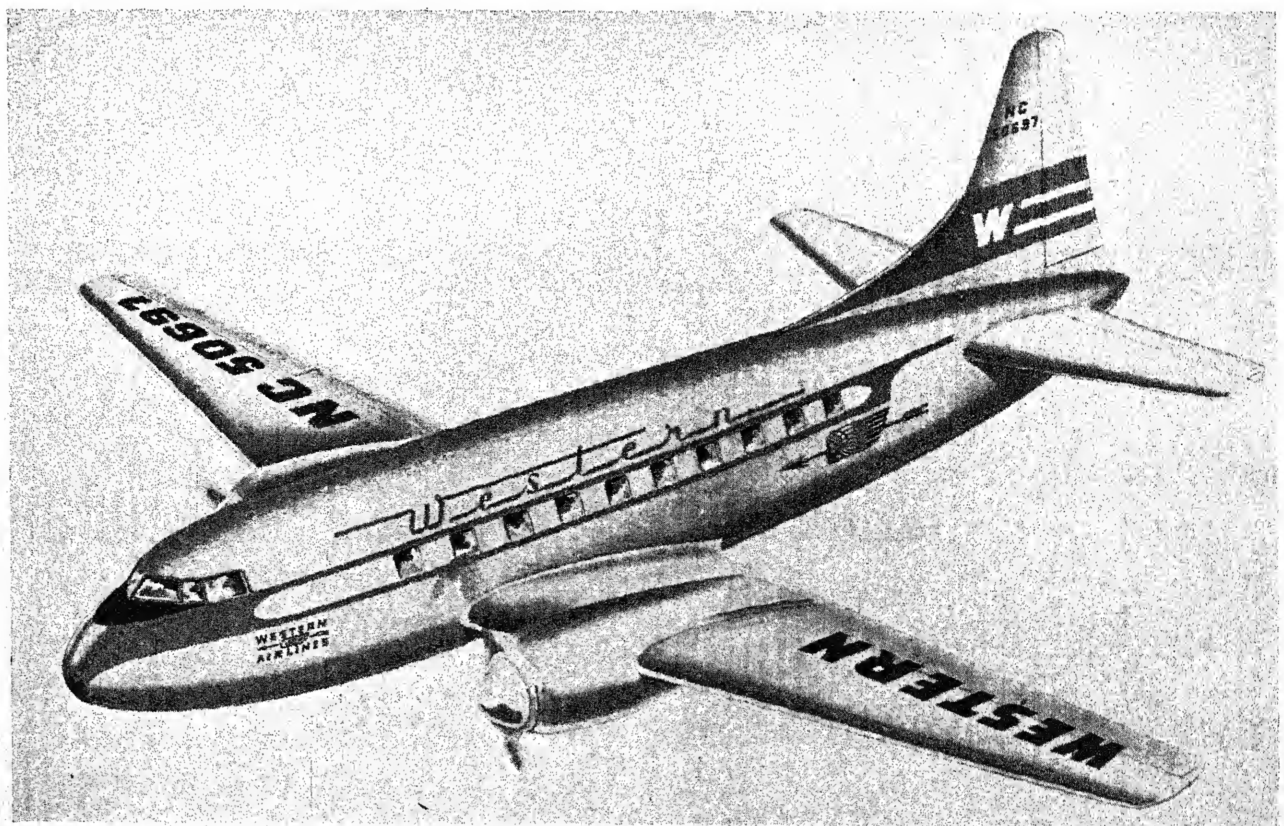
The XP-92 is a rocket-powered interceptor monoplane which is under development for the U.S.A.A.F. It has a designed speed of over 700 m.p.h. (1,120 km.h.) for a duration of approximately 5 minutes. Its conception is based on that of the German Messerschmitt Me 163 which was used in limited numbers against U.S. bomber formations in the closing stages of the war in Europe.

THE CONSOLIDATED VULTEE MODEL 109.

U.S. Army Air Forces designation : XB-46.

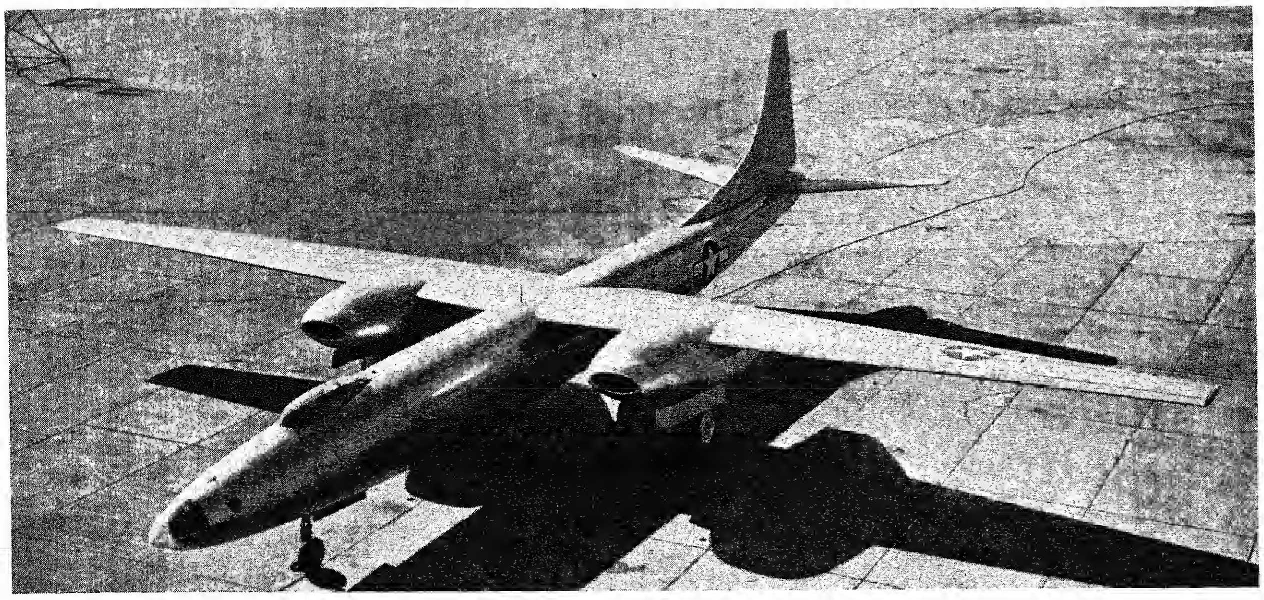
The XB-46 is an experimental four-jet medium bomber of which little information is available for publication, although the general arrangement can be seen from the accompanying illustration. The power-plant consists of four General Electric TG-180 turbo-jet units, which are paired in low-slung nacelles, one on each side of the fuselage.

Dimensions.—Span 113 ft. (34.4 m.), Length 105 ft. 9 in. (32.25 m.).



A drawing of the Consolidated Vultee Model 240 40-passenger Airliner.

CONSOLIDATED VULTEE—*continued.*



The Consolidated Vultee XB-46 Medium Bomber (four General Electric TG-180 turbo-jet engines).

THE CONSOLIDATED VULTEE MODEL 102.

U.S. Army Air Forces designation : XP-81.

The XP-81 was designed by Consolidated-Vultee, with the co-operation of Air Technical Service Command, Wright Field, as a long-range escort-fighter. Design work began in September, 1943, with the object of using the General Electric TG-100 airscrew turbine which was then being developed, and the I-40 jet unit. The propjet, however, was not completed by the time that the XP-81 was ready, so a few modifications were incorporated to allow for the installation of a Packard V-1650 Merlin twelve-cylinder Vee liquid-cooled engine as an interim power-plant until the TG-100 became available. Powered by the Merlin engine and the I-40 jet unit the XP-81 was first flown at the Muroc Experimental Test Base on February 11, 1945, and subsequent flight tests were made in this form until December 21, 1945, when the XP-81 flew with a TG-100 propjet in place of the Merlin.

Type.—Single-seat Escort Fighter Monoplane with gas turbine-driven airscrew and jet propulsion unit.

Wings.—Cantilever low-wing monoplane. NACA laminar-flow aerofoil section. All metal structure. Single main spar with flush-riveted aluminium-alloy stressed skin over forward 34.5% of wings forms D-shaped torsion box which extends to fuselage line-centre. Thinner sheet covering aft. Detachable inspection panels. Wing area 425 sq. ft. (29.48 sq. m.). All-metal ailerons with trim-tab in each, and trailing-edge flaps between ailerons and fuselage.

Fuselage.—Flush-riveted semi-monocoque structure of 24S-RT aluminium-alloy.

Tail Unit.—Cantilever monoplane type. Trim and balance-tabs in rudder and trim-tabs in both elevators.

Landing Gear.—Retractable tricycle type. Each main wheel, carried on single shock-absorber leg with side link member, retracts inwards into wing and is fully enclosed by fairing plates and hinged doors. Nose-wheel carried in half-fork retracts backwards into fuselage. Electric operation, with mechanical emergency gear.

Power Plant.—One General Electric TG-100 (U.S. Army designation T-31-1) axial-flow gas turbine driving a four-blade tractor airscrew 12 ft. 0 in. (3.66 m.) diameter, and emitting jet-exhaust from duct under the fuselage, and one General Electric I-40 (U.S. Army designation J-33-3) centrifugal-flow jet-propulsion unit mounted in aft section of fuselage and ejecting through aperture in extreme tail. Twin air-intakes for I-40 engine, one on each side of fuselage, above wing trailing-edge. Both engines burn kerosene, and may be used independently or together. Fuel tank in fuselage aft of cockpit. Long-range drop-tanks may be carried under wings.

Accommodation.—Pressurized cockpit for pilot. Forward portion of cover is fixed and has flat bullet-proof windscreen; blister type canopy slides back for access. Provision for refrigeration. 9 degrees 48 minutes downward vision from cockpit over nose.

Armament.—Six .5-in. (12.7 m/m.) machine-guns in leading-edge of wings, three on each side, outside airscrew disc. Provision for bombs or rocket-projectiles under wings.

Dimensions.—Span 50 ft. 6 in. (15.39 m.), Length 44 ft. 8 in. (13.61 m.), Height 13 ft. 6 in. (4.11 m.).

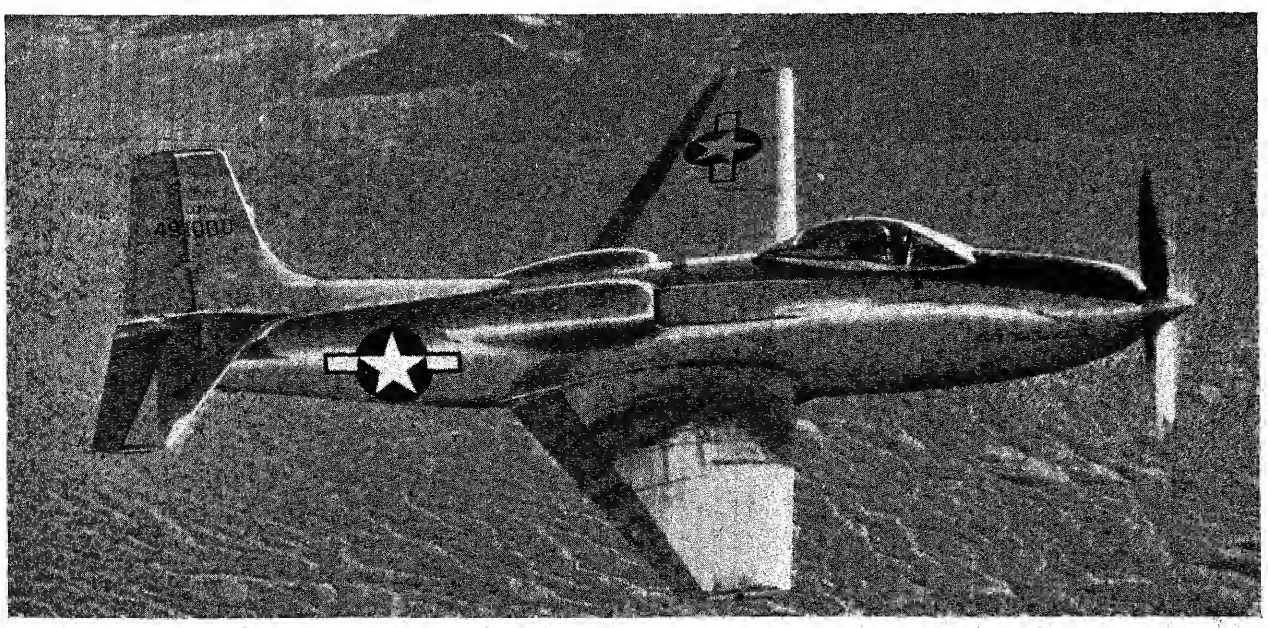
Weights and Loadings.—Weight loaded 19,500 lbs. (8,845 kg.), Wing loading (fully loaded) 45.88 lbs./sq. ft. (223.9 kg./sq. m.).

Performance.—No data available.

THE CONSOLIDATED VULTEE MODEL 100 PRIVATEER.

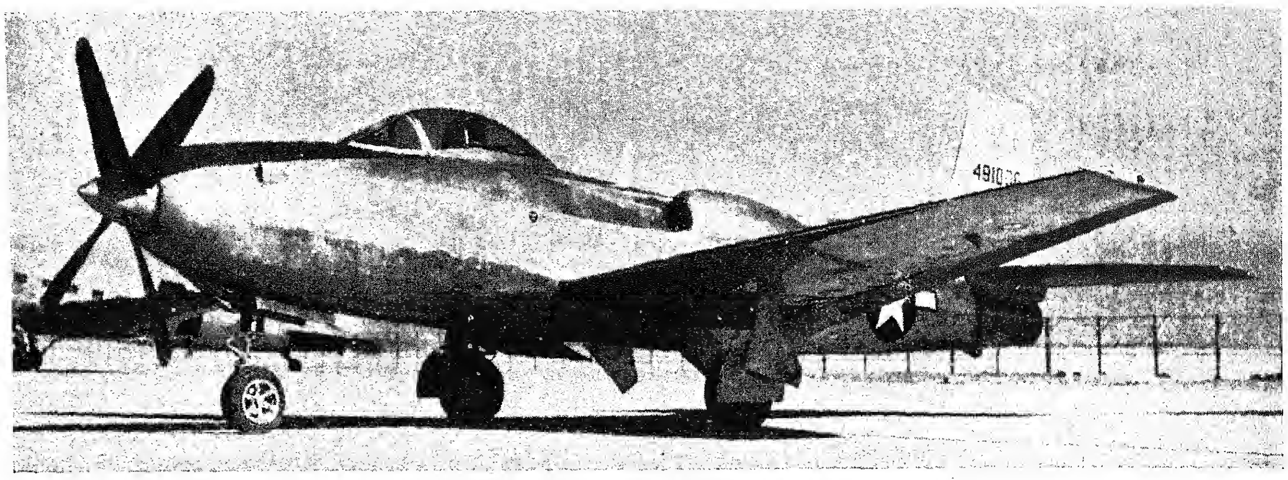
U.S. Navy designation : PB4Y-2.

The PB4Y-2 is a long-range oversea Bomber-Reconnaissance development of the PB4Y-1 Liberator. The original contract



The Consolidated Vultee XP-81 Single-seat Escort Fighter (General Electric TG-100 airscrew-turbine and I-40 turbo-jet unit).

CONSOLIDATED VULTEE—*continued*.



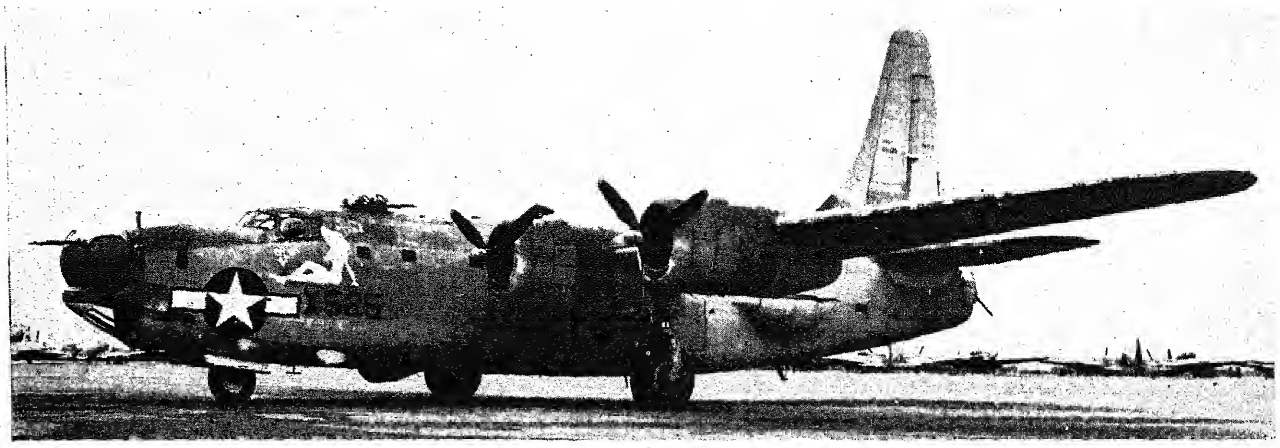
The Consolidated Vultee XP-81 Single-seat Escort Fighter.

for the PB4Y-2 was placed with the Consolidated Vultee Corpn. by the U.S. Navy in May, 1943, and work on three prototypes was begun almost immediately. Four months later, on September 20, the first prototype flew, followed on October 30 and December 15 by the second and third respectively.

The PB4Y-2 uses the same Davis wing and landing-gear as the Liberator. Otherwise it is a new design embodying most of the structural features of its predecessor.

The tail-unit is of the single rudder type with the tailplane set at a slight dihedral angle. The fixed surfaces are of stressed-skin construction, the movable surfaces having metal frames and fabric covering.

The power-plant consists of four 1,200 h.p. Pratt & Whitney R-1830-94 fourteen-cylinder radial engines each driving a three-blade Hamilton Standard Hydromatic airscrew with slinger-ring anti-icing equipment. The engines are enclosed in oval cowlings



The Consolidated Vultee PB4Y-2 Privateer Long-range Bomber Reconnaissance Monoplane (four Pratt & Whitney R-1830-94 engines).—(*Peter Bowers*).

The fuselage forward of the wings has been lengthened by 7 ft. (2.135 m.) and the armament has been rearranged to include a Consolidated nose-turret, two Martin dorsal turrets, one forward and one aft of the wings, a Consolidated tail-turret and two Erco blister type waist turrets, one on each side of the fuselage midway between wing and tail, all turrets being armed with two .5 in. (12.7 m/m.) Browning machine-guns. The fuselage bomb-bay is similar to that of the Liberator and can accommodate on normal missions 6,000 lbs. (2,722 kg.) of bombs or depth charges.

with the larger diameter vertical instead of horizontal as in the Liberator.

Accommodation is provided for a crew of eleven, comprising pilot and co-pilot, navigator, bombardier, five gunners and two radio-operators. The Convair hot-air system employing exhaust heat exchangers is used for cabin heating and for heated-surface de-icing for wings and tail-unit.

Dimensions.—Span 110 ft. (33.5 m.), Length 78 ft. 8 in. (24 m.), Height (over tail) 29 ft. (8.4 m.), Wing area 1,048 sq. ft. (97.4 sq. m.).

Weights and Loadings.—Weight empty 37,765 lbs. (17,145 kg.),

The Consolidated Vultee PB4Y-2M Privateer equipped for Meteorological Research duties.—(*William T. Larkins*).

CONSOLIDATED VULTEE—continued.

The Consolidated Vultee RY-3 Liberator Naval Transport (four Pratt & Whitney R-1830-94 engines).

Weight loaded 62,000 lbs. (28,250 kg.), Wing loading 59.1 lbs./sq. ft. (288.4 kg./sq. m.), Power loading 12.9 lbs./h.p. (5.83 kg./h.p.).

PERFORMANCE.—Maximum speed over 250 m.p.h. (400 km.h.), Cruising speed over 200 m.p.h. (322 km.h.), Stalling speed 93 m.p.h. (149 km.h.), Maximum range over 3,000 miles (4,828 km.).

THE CONSOLIDATED VULTEE MODEL 101.

U.S. Navy designation RY-3.

U.S. Army Air Forces designation : C-87C.

The RY-3 is a long-range transport conversion of the PB4Y-2. It makes use of the same wings, tail-unit, landing-gear and power-plant as the Privateer but has an entirely new transport fuselage capable of accommodating freight or passengers. The conversion is very similar to that undertaken to convert the B-24 Liberator into the C-87. As a personnel transport the RY-3 has accommodation for a crew of 4 and from 28 to 36 passengers according to range.

DIMENSIONS.—Span 110 ft. (33.5 m.), Length 75 ft. 5 in. (23 m.), Height (over tail) 29 ft. 2 in. (8.9 m.).

WEIGHTS.—Weight empty 30,359 lbs. (13,783 kg.), Weight loaded 60,000 lbs. (27,240 kg.).

PERFORMANCE.—As PB4Y-2.

THE CONSOLIDATED VULTEE MODEL 90.

U.S. Army Air Forces designation : XA-41.

The XA-41 monoplane was produced as a close-support aircraft for the U.S.A.A.F., and made its first flight on February 11, 1944, at Lomita, California. It was subsequently tested by both the A.A.F. at Eglin Field, Florida, and by the U.S. Navy at Patuxent, Maryland, but by the time it was ready for production, operational requirements rendered the type superfluous. Only one XA-41 was built and it is now used by Pratt & Whitney Aircraft at East Hartford, Conn., as a flying test-bed for new and experimental engine installations.

TYPE.—Single-seat single-engined Close-support Monoplane.

WINGS.—All-metal cantilever mid-wing monoplane. Wing built in four main sections consisting of two inner panels tapering in chord and thickness and attached direct to fuselage, and two outer panels set at dihedral angle. Detachable tips. Wing has one main spar with false spar at leading-edge and second false spar to which ailerons and flaps are hinged. Metal former ribs and stressed sheet covering. Mean aerodynamic chord 11 ft. 1.9 in. (3.40 m.). Wing area 544 sq. ft. (50.54 sq. m.) ; aspect ratio 5.4. All-metal ailerons with sheet metal covering. Inset trim-tabs. Slotted trailing-edge flaps in two sections between ailerons and fuselage.

FUSELAGE.—Oval-section all-metal monocoque structure in two main sections joined near wing trailing-edge. Four main longerons, channel-section vertical frames and stressed-skin covering. Heavy cross member to which main spar is attached.

TAIL UNIT.—All-metal cantilever monoplane structure with sheet metal covering. Mass-balanced rudder and elevators with inset trim-tabs. Fin extends along fuselage decking and is faired into D/F housing. Tailplane span 24 ft. 6 in. (7.46 m.).

LANDING GEAR.—Retractable two-wheel type. Each unit consists of cranked shock-absorber leg with wheel on inside, and side and rear link members. Inwards retraction. Tailwheel retracts into fuselage.

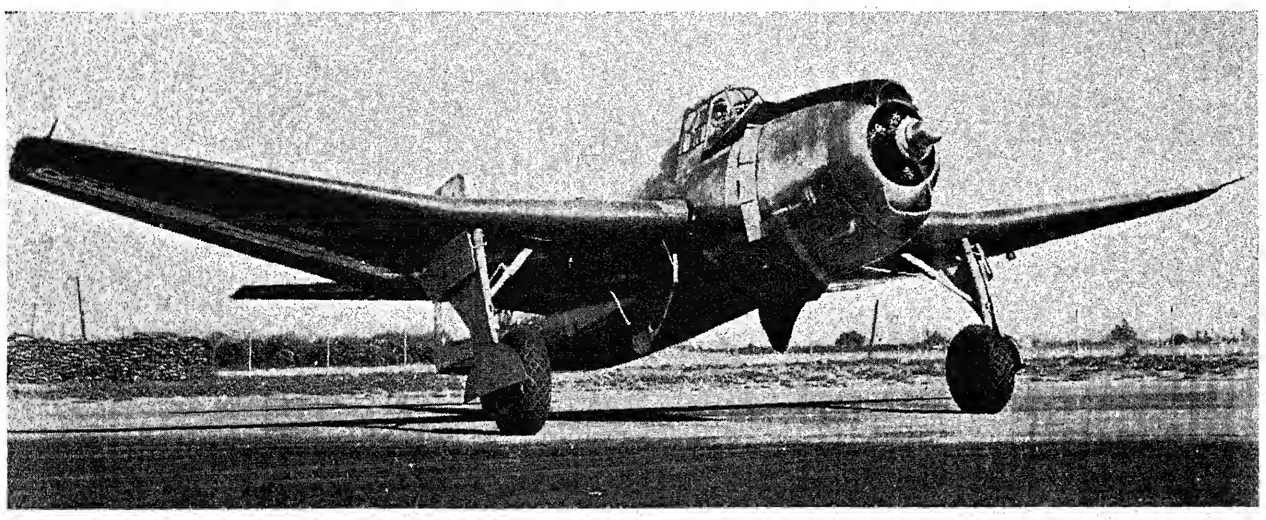
POWER PLANT.—One Pratt & Whitney R-4360-9 Wasp-Major 28-cylinder four-row radial air-cooled engine developing 3,000 h.p. and driving a four-blade constant-speed airscrew, 13 ft. 2 in. (4 m.) diameter. Cooling intake under cowling. Normal fuel capacity 350 U.S. gallons (1,321 litres) in fuselage tank. Maximum long-range ferrying capacity with extra tanks in bomb-bay 1,140 U.S. gallons (4,301 litres).

ACCOMMODATION.—Pilot's cockpit above leading-edge of wing covered by transparent canopy, centre portion of which hinges upwards for access. Moulded windscreen. Armour plating and steel-tube crash pylon behind pilot.

ARMAMENT.—Four 37 m/m. cannon (50 r.p.g.) mounted two in each inner wing section outboard of airscrew disc, and four .5-in. (12.7 m/m.) machine-guns (600 r.p.g.), two in each outer section. Maximum bomb load 6,400 lbs. (2,903 kg.), carried internally, may comprise fragmentation bombs, heavy bombs or torpedo.

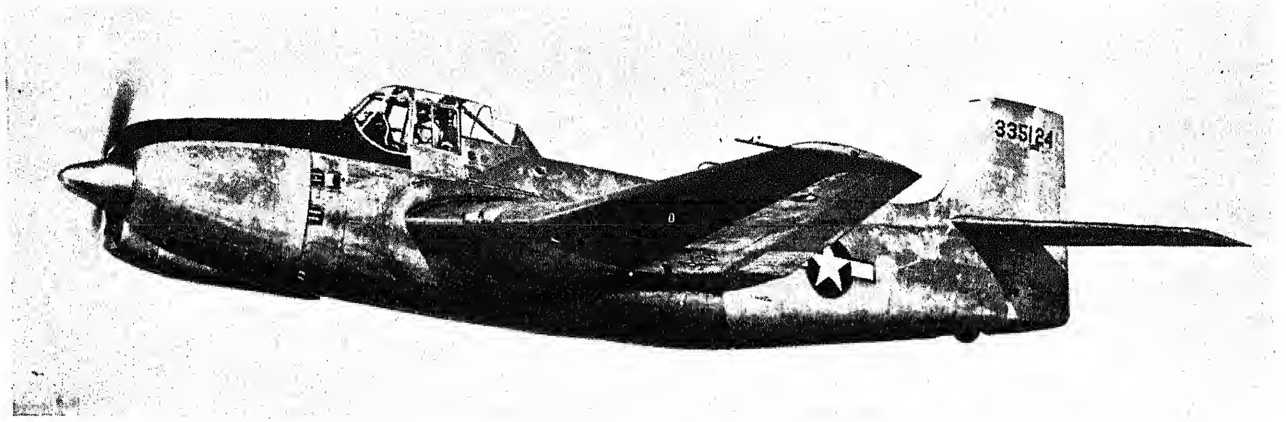
DIMENSIONS.—Span 54 ft. 0 in. (16.46 m.), Length 48 ft. 8 in. (14.83 m.), Height (tail down, one airscrew blade vertical) 13 ft. 11 in. (4.24 m.).

WEIGHTS AND LOADINGS.—Weight empty 13,336 lbs. (6,049 kg.), normal disposable load 5,354 lbs. (2,427 kg.), Maximum disposable load 10,852 lbs. (4,922 kg.), Normal loaded weight 18,690 lbs. (8,478 kg.), Maximum loaded weight 24,188 lbs. (10,971 kg.), Wing



The Consolidated Vultee XA-41 Single-seat Close-Support Monoplane (Pratt & Whitney R-4360-9 engine).

CONSOLIDATED VULTEE—*continued.*



The Consolidated Vultee XA-41 Single-seat Close-Support Monoplane (3,000 h.p. Pratt & Whitney R-4360-9 engine).

loading (normal loaded weight) 34.4 lbs./sq. ft. (168 kg./sq. m.), Power loading (normal loaded weight—take-off power) 6.2 lbs./h.p. (2.81 kg./h.p.).

PERFORMANCE.—Maximum speed (high blower) at 15,500 ft. (4,725 m.), 363 m.p.h. (584 km.h.), Maximum speed (low blower) at 5,100 ft. (1,555 m.) 354 m.p.h. (570 km.h.), Maximum speed (lower blower) at sea level 334 m.p.h. (437 km.h.), Cruising speed at 12,000 ft. (3,660 m.) on 1,475 h.p. 296 m.p.h. (476 km.h.), Stalling speed (with flaps) 74 m.p.h. (119 km.h.), Rate of climb at sea level 2,900 ft./min. (884 m./min.), Climb to 10,000 ft. (3,050 m.) lower blower 4.52 mins., Climb to 10,000 ft. (3,048 m.) high blower 3.9 mins., Service ceiling (high blower) 29,300 ft. (9,755 m.), Combat range 800 miles (1,287 km.), Ferrying range with extra tanks 3,000 miles (4,828 km.), Take-off distance over 50 ft. (15 m.) obstacle 500 yds. (457 m.).

THE CONSOLIDATED VULTEE MODEL 37.

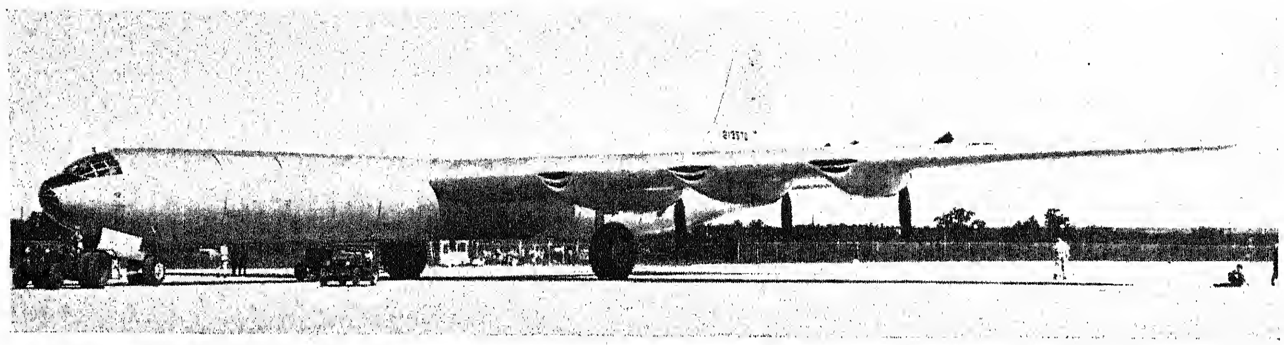
U.S. Army Air Force designation : XB-36.

TYPE.—Six-engined Heavy Bomber.

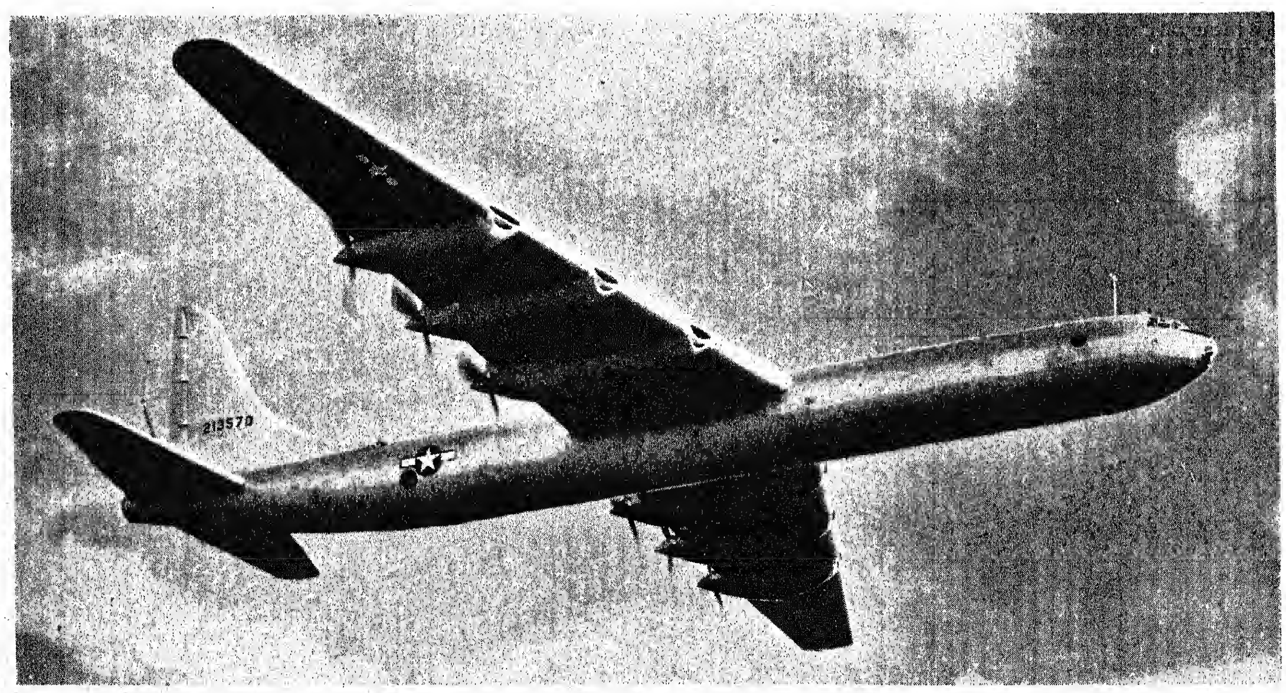
WINGS.—Cantilever mid-wing monoplane. NACA laminar-flow aerofoil section. All-metal tapered and swept-back structure with rounded tips. Leading-edge sweepback 15 degrees 6.5 minutes; trailing-edge sweepback 3 degrees. Gross wing area 4,772 sq. ft. (443.3 sq. m.). Statically-balanced ailerons with controllable trim-tab in each. Trailing-edge flaps in three sections each side. Total flap area 519 sq. ft. (443.3 sq. m.).

FUSELAGE.—All-metal structure of circular cross-section.

TAIL UNIT.—Cantilever monoplane type. Statically-balanced rudder and elevators with controllable trim-tab in each. Tailplane span 77 ft. 2 in. (23.52 m.). Total horizontal area 978 sq. ft. (90.85 sq. m.); total vertical area 542 sq. ft. (50.34 sq. m.).

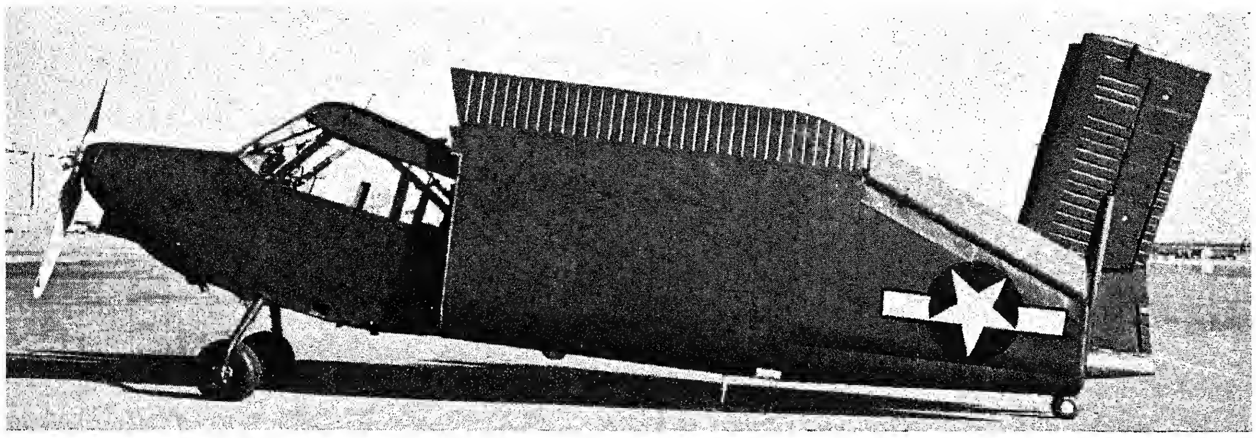


The Consolidated Vultee XB-36 Heavy Bomber (six 3,000 h.p. Pratt & Whitney R-4360-25 Wasp-Major engine).



The Consolidated Vultee XB-36 Heavy Bomber (six 3,000 h.p. Pratt & Whitney R-4360-25 Wasp Major engines).

CONSOLIDATED VULTEE—*continued.*



The Consolidated Vultee L-13 Two-seat Liaison Monoplane with wings and tail folded.

LANDING GEAR.—Retractable tricycle type. Prototype XB-36 has single main wheels 9 ft. 2 in. (2.79 m.) diameter carried on single cantilever hydraulic shock-absorber legs which retract inwards into wing and twin nose-wheels retracting rearwards into fuselage. Track 46 ft. 0 in. (14 m.); wheel base 74 ft. 7⅝ in. (22.75 m.). Production B-36 will have a new eight-wheel landing-gear.

POWER PLANT.—Six 3,000 h.p. Pratt & Whitney R-4360-25 Wasp-Major twenty-eight-cylinder four-row radial air-cooled engines mounted as pusher units and driving Curtiss Electric four-blade reversible-pitch hollow-steel airscrews, 19 ft. (5.79 m.) diameter. Thermal de-icing in airscrew blades. Fuel capacity 21,116 U.S. gallons (79,928 litres) in wing tanks. Oil capacity 1,200 U.S. gallons (4,542 litres).

ACCOMMODATION.—Crew of twelve, plus four relief members. Pressurized forward and aft cabins connected by 85 ft. (25.9 m.) magnesium tunnel; transportation by four-wheel trolley. Total pressurized volume 3,924 cub. ft. (116.14 cub. m.).

ARMAMENT.—Defensive armament not disclosed. Bomb-bay in four sections has volume of 12,300 cub. ft. (348 cub. m.). Maximum bomb load 72,000 lbs. (32,659 kg.).

DIMENSIONS.—Span 230 ft. 0 in. (70.14 m.), Length 163 ft. (49.68 m.), Height 46 ft. 7 in. (14.2 m.).

WEIGHTS AND LOADINGS.—Weight loaded 278,000 lbs. (126,100 kg.), Wing loading 58.25 lbs./sq. ft. (284.38 kg./sq. m.), Power loading 15.44 lbs./h.p. (7 kg./h.p.).

PERFORMANCE.—Maximum speed, over 300 m.p.h. (482 km.h.), Ceiling 40,000 ft. (12,190 m.), Range (with 10,000 lbs. = 4,536 kg. bomb-load) 10,000 miles (16,093 km.), Take-off distance to 50 ft. (15 m.) 1,666 yds. (1,523 m.).

THE CONSOLIDATED VULTEE XC-99.

The XC-99 is a transport version of the previously-described XB-36. It has an entirely new two-deck fuselage and will have accommodation for a crew of ten. Its total capacity will be 100,000 lbs. (45,400 kg.) or over 200 passengers.

Both aircraft use the same wings, landing gear, and tail-unit and both have six 3,000 h.p. Pratt & Whitney R-4360 engines mounted in the wings and driving Curtiss Electric three-blade pusher airscrews.

The following data relates to the XC-99, which was due for completion and flight trials in 1947.

DIMENSIONS.—Span 230 ft. (70.15 m.), Length 182 ft. 6 in. (55.6 m.), Height (over tail) 57 ft. 6 in. (17.5 m.).

WEIGHTS.—Weight empty 130,455 lbs. (59,226 kg.), Useful load 100,000 lbs. (45,359 kg.), Disposable load 134,545 lbs. (61,084 kg.), Weight loaded 265,000 lbs. (120,310 kg.).

PERFORMANCE (estimated).—Cruising speed 310 to 342 m.p.h. (496 to 547 km.h.) according to altitude and power output, Stalling speed 93 m.p.h. (149 km.h.), Service ceiling 30,000 ft. (9,145 m.), Maximum range 8,100 miles (12,960 km.).

THE CONSOLIDATED VULTEE L-13.

The L-13 is a two/three-seat monoplane designed as a general liaison, observation, photographic and ambulance aircraft, and is in production at the Consolidated Vultee San Diego factory for the U.S.A.A.F. Large trailing-edge flaps and fixed leading-edge slats have been incorporated to permit steep take-off and landing angles. An unusual feature of the design is in the folding of the tailplane. With the airscrew removed the L-13 can be towed as a glider by another aircraft.

TYPE.—Two/three-seat Liaison and Ambulance Monoplane.

WINGS.—Braced high-wing monoplane. Structure consists of two inner and two outer sections attached to *cabane* and braced to lower fuselage longerons by a single steel-tube strut on each side. Constant-chord inner sections; outer sections have sharp taper on trailing-edge and slightly swept-back leading-edge. All-metal riveted two-spar structure with aluminium-alloy sheet covering. Wings arranged to fold rearwards from roots about rear spar with leading-edge downwards. Securing bolts on front spar. Manual operation. Dihedral 2½ degrees; root chord 7 ft. 6 in. (2.29 m.); tip chord 3 ft. 9 in. (1.14 m), wing area 270 sq. ft. (25.08 sq. m.). Double-slotted ailerons with fixed auxiliary aerofoil, and trim-tab in each. Single-spar construction, with diagonal torque ribs and

The Consolidated Vultee L-13 Two-seat Liaison Monoplane (245 h.p. Franklin O-425-5 engine).

CONSOLIDATED VULTEE—*continued.*

fabric covering. Aileron span 6 ft. 3 in. (1.90 m.); aileron chord 1 ft. 2¼ in. (0.36 m.); aileron area (each) 18.8 sq. ft. (1.75 sq. m.); aileron movement 30 degrees up; 15 degrees down. Slotted trailing-edge flaps between ailerons and fuselage. Manual operation. Flap span 12 ft. (3.66 m.); flap chord 2 ft. 3 in. (0.69 m.); flap area (each) 25 sq. ft. (2.32 sq. m.); flap depression 45 degrees. Fixed-type leading-edge slats of metal construction bolted on. Slat span 8 ft. 0 in. (2.44 m.).

Fuselage.—All-metal structure in two main sections bolted together. Forward section is a welded steel-tube truss-type structure; rear section of aluminium-alloy semi-monocoque construction.

Tail Unit.—Monoplane type. Fin of aluminium-alloy construction built integral with fuselage and metal covered. Metal-framed horn-balanced rudder has single spar and fabric covering. All-metal constant-chord tailplane with metal covering mounted half-way up fin and braced to fuselage by single steel-tube strut on each side. Horn-balanced elevators of single-spar construction with fabric covering. Controllable trim-tab in port elevator. Horizontal surfaces hinged at roots and fold upwards when wings are folded. Tailplane span 13 ft. 8 in. (4.16 m.); tailplane span (folded) 6 ft. 10 in. (2.08 m.); tailplano and elevator chord 3 ft. 9 in. (1.14 m.); tailplane area 30 sq. ft. (2.78 sq. m.); elevator area (total) 20 sq. ft. (1.86 sq. m.); elevator movement 25 degrees up; 15 degrees down. Fin area 14 sq. ft. (1.30 sq. m.); rudder area 9 sq. ft. (0.84 sq. m.).

Landing Gear.—Fixed two-wheel type. Each wheel carried on single cantilever leg attached to fuselage. Track 7 ft. 10.58 in. (2.40 m.). Track can be reduced to 5 ft. 1.6 in. (1.54 m.) for ground towing by swinging wheels to inside of legs. Non-retractable tail-wheel. Loops on main legs permit aircraft to be towed as glider. Hydraulic expander-type brakes on main wheels, toe-operated. Twin float or ski undercarriage optional.

Power Plant.—One 245 h.p. Franklin O-425-5 six-cylinder horizontally-opposed air-cooled engine driving two-blade variable-pitch wooden airscrew 9 ft. 0 in. (2.74 m.) diameter. Airscrew clearance (tail up) 9 in. (22.86 c/m.). Fuel capacity 46 U.S. gallons (174 litres).

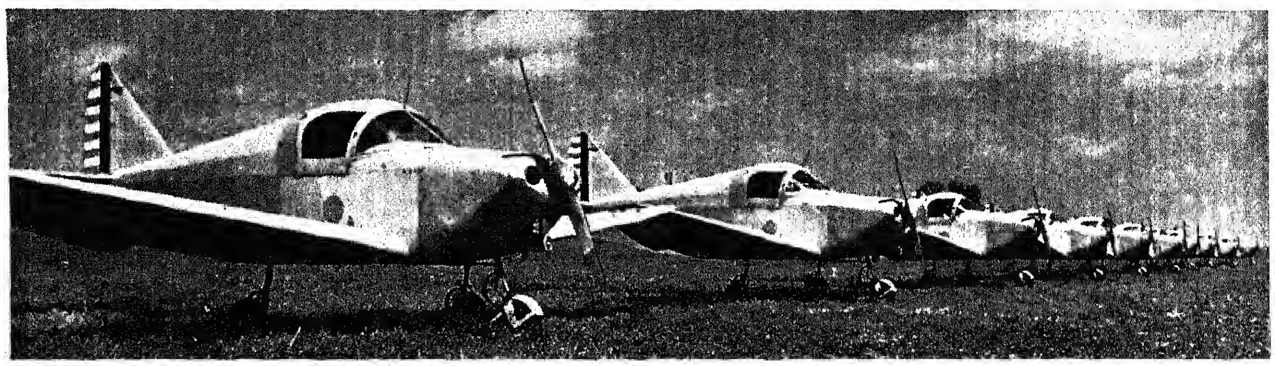
Accommodation.—Normal crew of three. Enclosed cabin seating pilot and observer side-by-side, and third member aft. Plexiglas windscreen and side and roof windows. For use as ambulance pilot and observer sit in tandem, with two stretchers between. Three jettisonable doors, two on starboard and one on port. Post between doors on starboard side can be removed for loading stretchers. In emergency six occupants can be carried. Windows slope outward at top to permit downward vision. Windows in doors hinged at bottom edges so as to open outwards and lie flat against fuselage.

Dimensions.—Span 40 ft. 5½ in. (12.33 m.), Length 31 ft. 9 in. (9.67 m.), Height (tail down, over cabin) 8 ft. 5 in. (2.97 m.), Height (tail up, over rudder) 13 ft. 10 in. (4.22 m.).

Weights and Loadings.—Weight empty 1,888 lbs. (856 kg.), Disposable load 1,012 lbs. (459 kg.), Weight loaded 2,900 lbs. (1,315 kg.), Wing loading 10.74 lbs./sq. ft. (52.43 kg./sq. m.), Power loading 11.8 lbs./h.p. (5.34 kg./h.p.).

Performance.—Maximum speed 115 m.p.h. (185 km.h.), Cruising speed 92 m.p.h. (148 km.h.), Landing speed 43.5 m.p.h. (70 km.h.), Service ceiling 15,000 ft. (4,570 m.), Range 368 miles (592 km.), Range (with extra tank) 750 miles (1,207 km.), Take-off run 77 yds. (70 m.), Take-off distance to 50 ft. (15 m.) 157 yds. (144 m.), Landing run 76 yds. (69 m.), Landing distance from 50 ft. (15 m.), 161 yds. (147 m.).

CULVER.



A line-up of Culver PQ-8 (TDC-1) Radio-Controlled Target Drones (90 h.p. Franklin O-200-1 engine).

CULVER AIRCRAFT CORPORATION.

Head Office and Works: 600, East 35th Street, Wichita, Kansas.

President: Van Grant.

Vice-President and General Manager: T. Steppe.

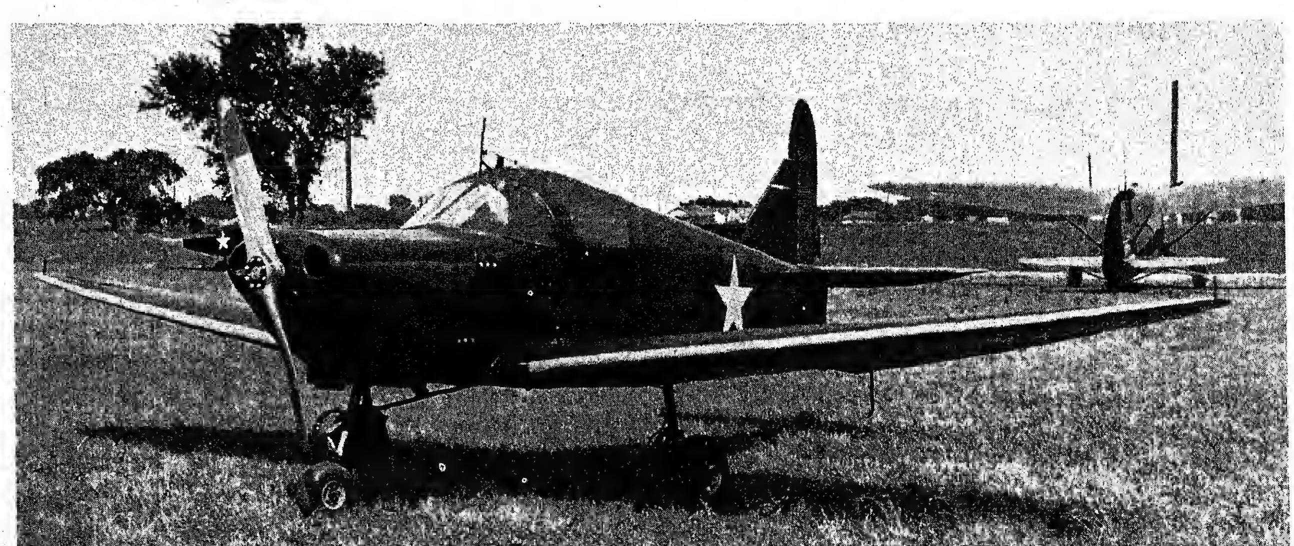
Secretary-Treasurer: Felix M. Farrell.

General Sales Manager: Robert R. Nadal.

The Culver Aircraft Corporation was formed in 1939 to take over from the Dart Manufacturing Corporation the manufacturing and sales rights of the Dart Model G two-seat light cabin monoplane.

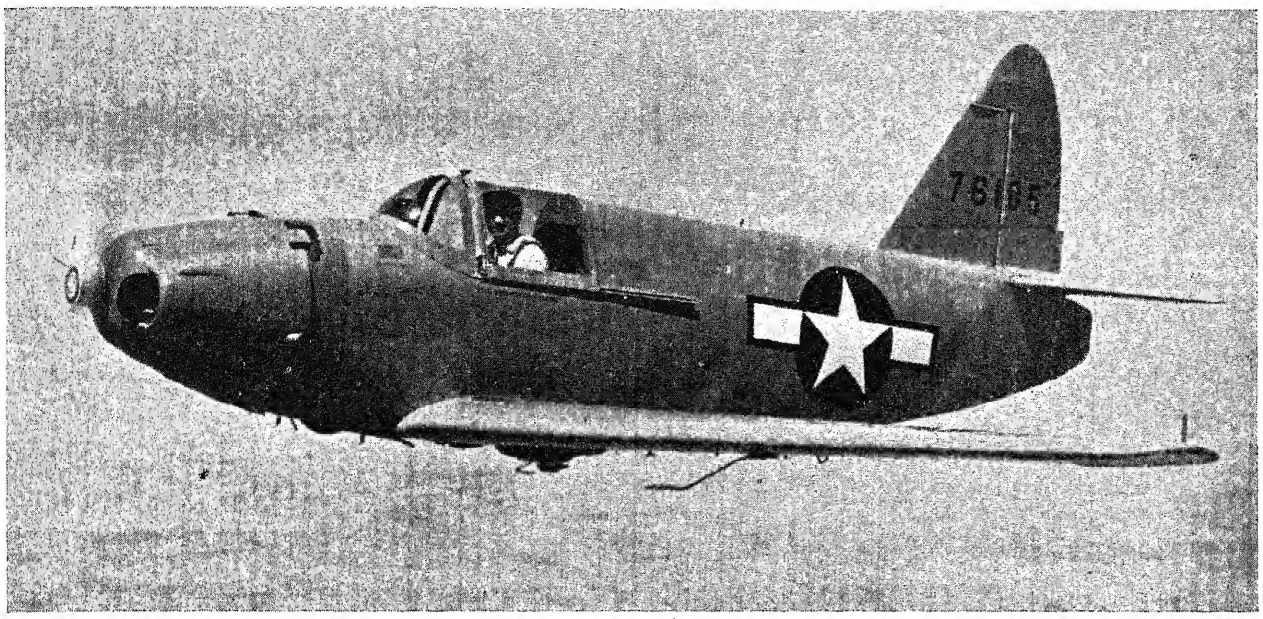
In the following year the company produced the Culver light cabin monoplane with retractable undercarriage. This was marketed in two versions, the Model LFA with the 80 h.p. Franklin engine, and the Model LCA with the 75 h.p. Continental engine. These two models were last described and illustrated in the 1942 issue of this Annual. Production of these models was discontinued on the entry of America into the War, although many of them were used during the war for C.A.P. service and other civilian duties, and are still widely used by private owners.

In August, 1940, U.S. Government embarked on the task of perfecting the principle of radio-control for target use in training air and anti-aircraft gunners. The Culver Company, then located at a small plant in Columbus, Ohio, was invited with some twenty other light aircraft manufacturers to submit designs for an aircraft which could be radio-controlled for target purposes. The Culver design was the only one accepted,



The Culver PQ-8A (TDC-2) Radio-Controlled Target Drone (125 h.p. Lycoming O-290 engine).

***CULVER**—continued.*



The Culver TD2C-1 (PQ-14) Radio-Controlled Target Drone (150 h.p. Franklin O-300-11 engine).

and the Company subsequently became the sole production supplier to both the Army and Navy of radio-controlled aircraft throughout the War.

When the first Army contract was received, the Culver Company moved to a larger factory at Wichita, Kansas, and for the duration of the war the production facilities of the company were devoted entirely to this type of aircraft. The U.S. Navy contract for the TD2C-1 (Army PQ-14) was completed in April, 1946, and since then the Culver factory has been turned over entirely to commercial production.

Three basic models of the radio-controlled aircraft were built by Culver for the Army, with corresponding models for the Navy. These were the PQ-8 (Navy TDC-1); the PQ-8A (Navy TDC-2) and the PQ-14 (Navy TDC2-1). The XPQ-9 and XPQ-10 were experimental designs which were not proceeded with. The XPQ-15 (Navy XTD3C-1) was an experimental development of the PQ-14 with the Franklin O-405 engine.

In the Spring of 1943 Culver began design work on a post-war commercial model which had been under study since 1940. This aircraft, known as the Model V, was first test-flown at Wichita in September, 1945.

THE CULVER PQ-8.

U.S. Navy designation : TDC-1.

The PQ-8 was the first radio-controlled target designed and built by the Culver Company for the U.S. Army. It was a development of the earlier civilian Model LFA and was generally similar except that a fixed tricycle landing-gear replaced the retractable two-wheel undercarriage of the civilian aircraft. It was powered by a Franklin O-200-1 four-cylinder horizontally-opposed air-cooled engine rated at 90 h.p. at 2,500 r.p.m., and had a loaded weight of 1,105 lb. (501 kg.). The wing span was 26 ft. 11 ins. (8.20 m.).

Performance.—Maximum speed 110 m.p.h. (177 km.h.), Landing speed 53 m.p.h. (85 km.h.), Service ceiling 18,200 ft. (5,545 m.), Range 300 miles (483 km.), Endurance 3½ hours.

THE CULVER PQ-8A.

U.S. Navy designation : TDC-2.

The PQ-8A was a development of the PQ-8 and was powered by a Lycoming O-290-1 four-cylinder horizontally-opposed air-cooled engine developing 125 h.p. at 2,450 r.p.m. A modified tail-unit with a larger rudder and dorsal fin was incorporated. The gross weight was 1,321 lb. (599 kg.) and the speed was increased to 130 m.p.h. (209 km.h.).

THE CULVER PQ-14.

U.S. Navy designation : TDC2-1.

Type.—Radio-controlled Target Drone

Wings.—Low-wing cantilever monoplane. Wooden structure with two laminated spars passing through fuselage, wooden ribs and stressed plywood skin. Wooden ailerons with stressed plywood skin. Electrically-operated trailing-edge flaps between ailerons and fuselage. Fixed slots near wing-tips.

Fuselage—Wooden structure with stressed plywood skin.

Tail Unit.—Cantilever monoplane type. Fin and tailplane of wooden construction with stressed plywood skin. Elevators and statically-balanced rudder have metal framework with fabric covering. Rudder-tab adjustable on ground only. Controllable elevator trim.

Landing Gear.—Retractable tricycle type. Main wheels carried on air-oil shock-absorber struts which retract inwards into wing. Steerable nose-wheel retracts backwards into fuselage. Electric operation with automatic locking. Goodyear hydraulic brakes in main wheels. Nose wheel rotates 6½ degrees right and 5½ degrees left.

Power Plant.—One Franklin O-300-11 six-cylinder horizontally-opposed air-cooled engine developing 150 h.p. at 2,930 r.p.m. and driving a Sensenich 66CA-63 two-blade fixed-pitch wooden airscrew. Three fuel cells in each wing. Maximum capacity 26 U.S. gallons (100 litres). 100-octane fuel. Oil capacity 2 U.S. gallons (7.5 litres).

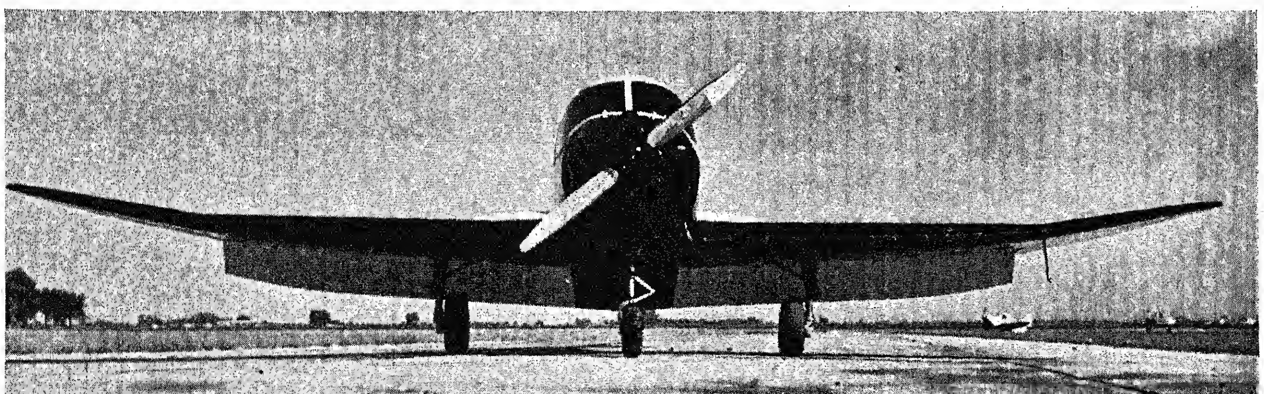
Accommodation.—Cockpit for ferry pilot or safety pilot has metal-framed sliding cover of cellulose acetate. Windshield of moulded acrelytic plastic with metal former at top.

Equipment.—Full radio equipment for flight control, and receiver and transmitter for use when pilot carried.

Dimensions.—Span 30 ft. 0 in. (9.14 m.).

Weight Loaded.—1,820 lbs. (825 kg.).

Performance (without pilot).—Maximum speed 180 m.p.h. (290 km.h.) at sea level; speed at 17,000 ft. (5,180 m.) 165 m.p.h. (265 km.h.), Service ceiling 17,000 ft. (5,180 m.), Range 594 miles (956 km.), Endurance 3.6 hours.



The Culver Model V Two-seat Cabin Monoplane (85 h.p. Continental C85 engine).

CULVER—*continued.*

The Culver V Two-seat Cabin Monoplane (85 h.p. Continental C85 engine).—(*Martin & Kelman*).

THE CULVER MODEL V.

The Model V is a two-seat cabin monoplane incorporating many features developed for the PQ series, including an electrically-operated retractable landing gear. An interesting feature of this aircraft is a new automatic trim control known as the "Simpli-Fly" system. This consists of a gear which links the elevator trim-tab to the flaps, thus automatically establishing proper settings for take-off, climb, approach and landing.

TYPE.—Two-seat Cabin monoplane.

WINGS.—Cantilever low-wing monoplane, consisting of long-span centre-section with swept-back leading-edge and two upswept outer sections with straight leading-edge and elliptical trailing-edge. Wooden spars and ribs and plywood covering, over which is a covering of fabric. Curved surfaces pre-formed under heat. Wooden ailerons with plywood covering on outer wings. Manually-operated all-wood plain-hinge trailing-edge flaps between ailerons, extending under fuselage. Flaps linked to elevator trim-tab. Wing area 125.9 sq. ft. (11.69 sq. m.).

FUSELAGE.—Plywood semi-monocoque structure, with fabric covering over all.

TAIL UNIT.—Cantilever monoplane type. Wooden structure with plywood covering. One-piece elevator with inset trim-tab which is linked to wing flaps. Tailplane span 9 ft. 2 in. (2.79 m.).

LANDING GEAR.—Retractable tricycle type. Each main wheel (Firestone 6.00 × 6) carried on oleo-pneumatic shock-absorber leg retracts inwards into wing. Electric operation, with emergency manual gear. Track 8 ft. 1½ in. (2.47 m.). Steerable nose-wheel (Firestone 5.00 × 4) carried in fork on shock-absorber leg retracts rearwards into fuselage. Firestone hydraulic brakes and tyres.

POWER PLANT.—One Continental C85-12 four-cylinder horizontally-opposed air-cooled engine rated at 85 h.p. at 2,575 r.p.m. and driving Sensenich two-blade adjustable-pitch wooden airscrew. Fuel capacity 32 U.S. gallons (145 litres) in Goodyear rubber-nylon wing tanks.

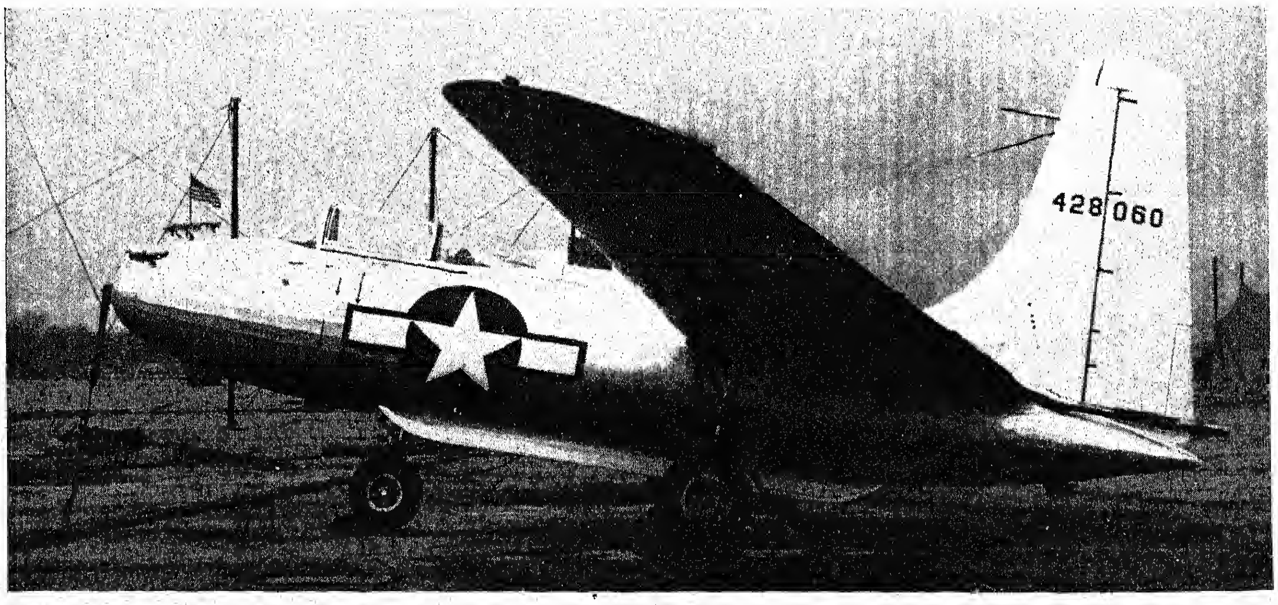
ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Lucite windshield. Access door on each side. Two baggage compartments, one ahead of instrument panel with allowance of 60 lbs. (27 kg.) and one aft of seats with allowance of 10 lbs. (4.5 kg.). Total capacity 3.5 cub. ft. (0.33 cub. m.). "Simpli-Fly" control system.

DIMENSIONS.—Span 29 ft. (8.84 m.), Length 20 ft. 8½ in. (6.31 m.), Height 6 ft. 9½ in. (2.07 m.).

WEIGHTS AND LOADINGS.—Weight empty 1,070 lbs. (485 kg.), Disposable load 530 lbs. (240 kg.), Weight loaded 1,600 lbs. (725 kg.). Wing loading 12.7 lbs./sq. ft. (52 kg./sq. m.), Power loading 18.8 lbs./h.p. (8.5 kg./h.p.).

PERFORMANCE.—Cruising speed 125 m.p.h. (201 km.h.), Initial rate of climb 660 ft./min. (201 m./min.), Service ceiling 13,100 ft. (3,990 m.), Cruising range 700 miles (1,127 km.), Fuel consumption 5.4 U.S. gallons/hr. (20.5 litres/hr.).

CORNELIUS.



The Cornelius XFG-1 Fuel-carrying Glider.—(*William T. Larkins*).

THE CORNELIUS AIRCRAFT CORPORATION.

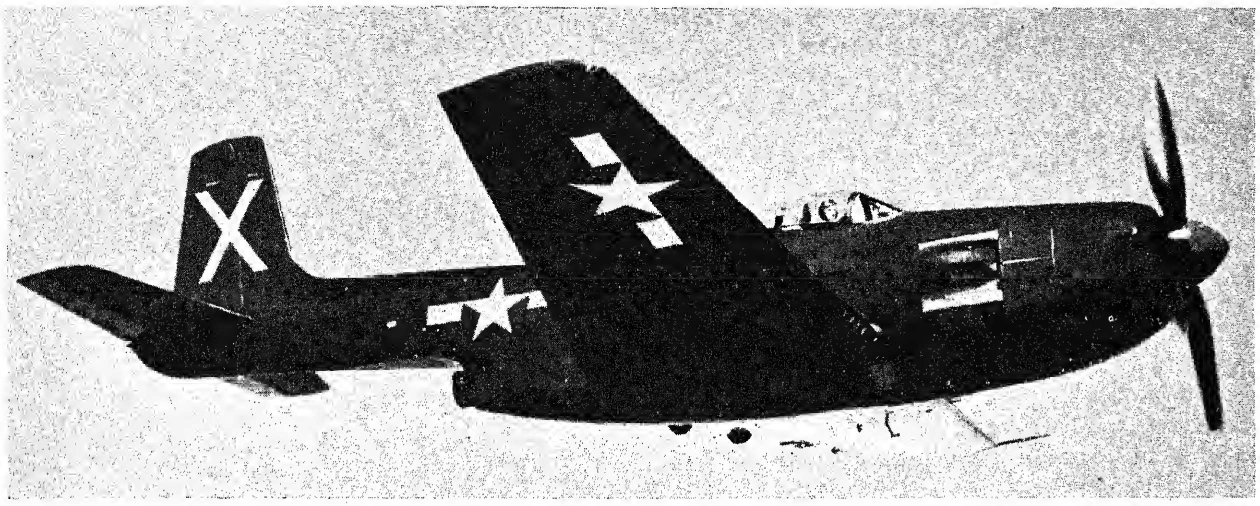
HEAD OFFICE: 809, NORTH AVENUE, DAYTON, OHIO.

The Cornelius Corporation built two experimental fuel-carrying gliders for the U.S. Army under the designation XFG-1. Although fitted with pilot's cockpit and a complete set of flight controls, the XFG-1 was intended to be towed behind bombers on long-range flights and to be cut adrift when empty.

The XFG-1, which is shown in the accompanying illustration, was a tail-less monoplane the wings of which were adjustable on the ground to vary the dihedral angle from 3 to 7 degrees. The tricycle landing-gear was jettisonable. The fuselage contained two tanks holding a total of approximately 700 U.S. gallons (2,650 litres). Two XFG-1's were built, but one crashed during spin tests.

Cornelius also designed a glider-bomb under the designation XBG-3, but this project was cancelled.

CURTISS.



The Curtiss XF15C-1 Single-seat Naval Fighter in its original form. It has a Pratt & Whitney R-2800-3W engine in the nose and an Allis-Chalmers (de Havilland) H-1B gas-turbine exhausting beneath the fuselage.

THE CURTISS-WRIGHT CORPORATION.

General Offices: 30, Rockefeller Plaza, New York 20, N.Y.

President: Guy W. Vaughan.

Executive Assistant to President: Rear Admiral L. B Richards.

Vice-Presidents: J. A. B. Smith, B. S. Wright, W. D. Kennedy, J. S. Allard, R. L. Earle, W. F. Goulding, S. D. Irwin and P. I. Morton.

Secretary and Treasurer: Joseph P. McCarthy.

The Curtiss-Wright Corporation operates three Divisions, the Curtiss-Wright Airplane Division (Aircraft), the Wright Aeronautical Corporation (Aero-engines) and the Curtiss-Wright Propeller Division (Propellers). Details of the products of the Curtiss-Wright Airplane Division will be found below. Full details of the products of the Wright Aeronautical Corporation will be found under "Wright" in the Aero-engine Section (d).

THE CURTISS-WRIGHT CORPORATION, AIRPLANE DIVISION.

Works: Columbus, Ohio.

Established: 1910.

President: Guy W. Vaughan.

Vice-President in Charge of Airplane Division: Robert L. Earle.

General Manager: J. P. Davey.

Assistant to General Manager: G. A. Snodgrass.

Factory Manager: R. A. Fuhrer.

Controller: J. A. Lawler.

Director of Engineering: G. A. Page, Jr.

Chief Engineer: R. C. Blaycock.

During the past year the Airplane Division of the Curtiss-Wright Corpn. has been engaged in the consolidation of its manufacturing facilities into a single plant at Columbus, Ohio, following the closing of other plants operated during the war.

A total of 22,977 complete aircraft were produced by Curtiss from December 7, 1941, until the cancellation of war contracts on and after August 14, 1945. Plants in production during the war were located at Buffalo, N.Y., the oldest Curtiss plant and then headquarters of the company; Kenmore, N.Y., Columbus, Ohio; St. Louis, Mo. and Louisville, Ky. Buffalo produced 14,043 aircraft, including P-40 Warhawks and C-46 Commandos; Columbus built 6,473 SO3C Seagulls, SB2C Helldivers and SC Seahawks; St. Louis 2,436 aircraft, chiefly C-46 Commandos and A-25 Helldivers; and the Louisville plant, which did not begin operations until 1943, turned out C-46 Commandos and undertook Boeing B-29 modification until it closed down in the Summer of 1945.

The Curtiss-Wright Corporation Airplane Division's Research Laboratory at Buffalo built flying devices which had achieved speeds of over 1,400 m.p.h. (2,240 km.h.) in a research programme concerned with the study of high-speed problems. A telemetering system was developed by which it is possible to record and study performance data of an object in flight by televising the images on an instrument panel from the object in flight to a mobile receiving unit on the ground. In December the Research Laboratory was presented to Cornell University for co-operative education-research. Previously the laboratory had received the Naval Ordnance Development Award "for distinguished service to the research and development of naval ordnance."

Various experimental aircraft now under development by Curtiss-Wright include the XA-43, a multiple-jet Attack-Bomber, and the XP-87 jet-propelled fighter. Intensive research is proceeding on a number of other projects for the U.S. Army and Navy.

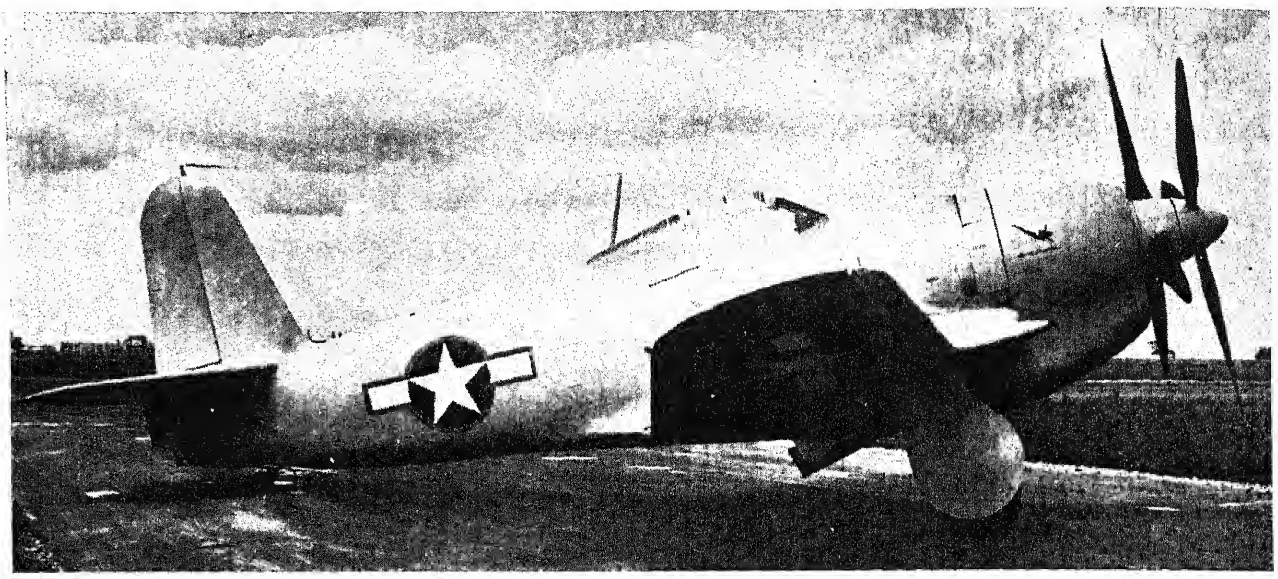
THE CURTISS XF15C-1.

Type.—Single-seat Fighter with both conventional tractor airscrew and jet propulsion unit.

Wings.—All-metal cantilever low-wing monoplane. Wing built in three sections consisting of centre-section and two outer wings. All-metal ailerons with trim-tab in port and trim and balance-tab

The Curtiss XF15C-1 Naval Fighter in its latest form with tailplane removed to the top of the fin.—(*Martin & Kelman*).

CURTISS—*continued.*



The Curtiss XF14C-2 Experimental Single-seat Fleet Fighter (Wright R-3350-16 engine driving contra-rotating airscrews).

in starboard. Trailing-edge flaps between ailerons extending under fuselage almost to centre-line. Outer sections of wings fold upwards to meet above centre-line of fuselage. Mean aerodynamic chord 8 ft. 9.3 in. (2.67 m.). Wing area 400 sq. ft. (37.16 sq. m.).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. Trim-tabs in balanced rudder and elevators. Tailplane span 20 ft. 0 in. (6.1 m.).

LANDING GEAR.—Retractable tricycle type. Main wheels, each carried by single shock-absorber leg attached mid-way between fuselage and extremity of centre-section, retract inwards under fuselage. Nose-wheel, carried in shock-absorber fork, retracts backwards into fuselage. Deck arrester hook under rear fuselage. Track 11 ft. 11½ ins. (3.66 m.), Wheel base 12 ft. 2 in. (3.71 m.).

POWER PLANT.—Combination of conventional engine driving tractor airscrew and gas turbine. Forward unit is a Pratt & Whitney R-2800-3W eighteen-cylinder two-row radial air-cooled engine driving a Hamilton Standard four-blade airscrew, 13 ft. 1 in. (3.98 m.) diameter. Rear unit is an Allis-Chalmers (D.H.) H.1B gas-turbine ejecting at point aft of trailing-edge of wing and under upswept rear portion of fuselage. Intakes in leading-edge of centre-section.

ACCOMMODATION.—Pilot's cockpit mounted above fuselage over leading-edge of wing. Flat bullet-proof windscreen. Rear portion of canopy slides for access.

ARMAMENT.—Four forward-firing guns mounted two in each centre-section outside airscrew disc.

DIMENSIONS.—Span 48 ft. 0 in. (14.63 m.), Width folded 20 ft. 5 in. (6.22 m.). Length (tail up) 43 ft. 8½ in. (13.32 m.). Height (on ground over rudder) 15 ft. 3 in. (4.65 m.), Height folded 17 ft. 0 in. (5.18 m.) Maximum height during folding 20 ft. 3 in. (6.16 m.).

WEIGHTS AND PERFORMANCE.— No data available.

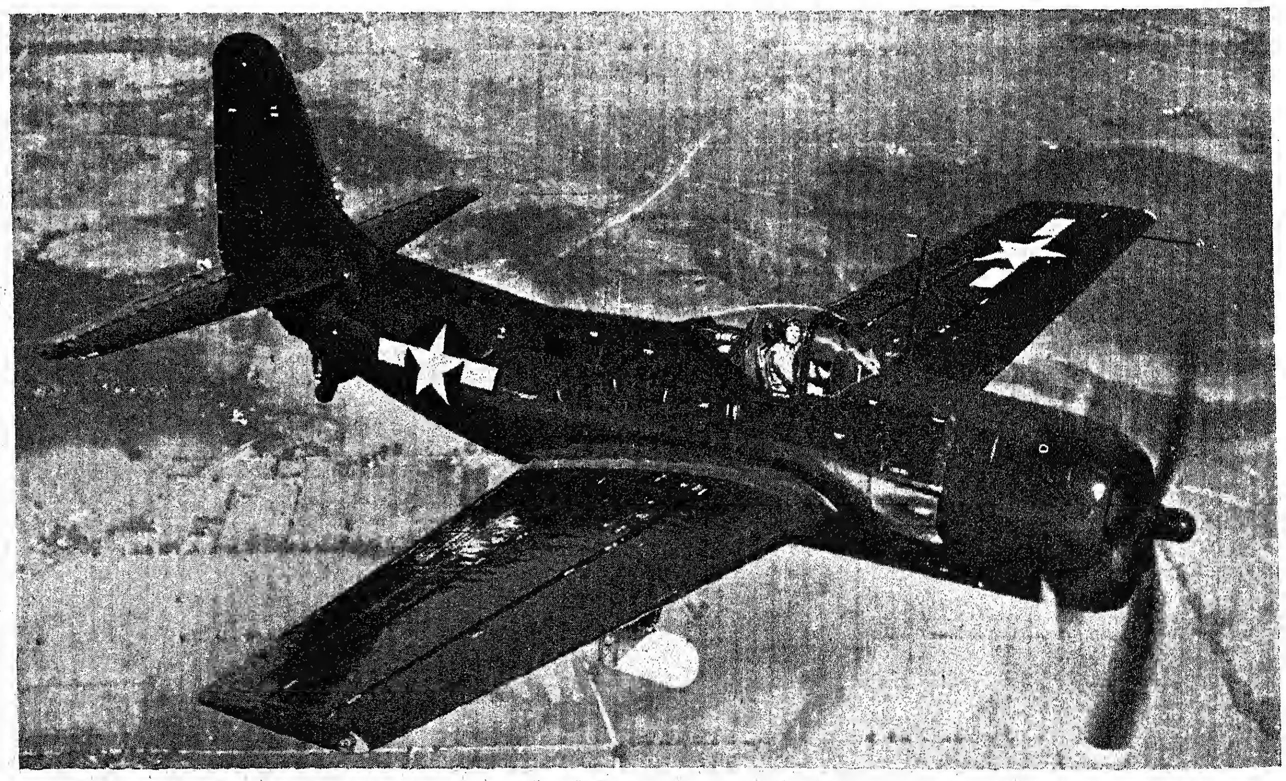
THE CURTISS XF14C-2.

The XF14C-2 was an experimental high-altitude single-seat carrier fighter. It was originally designed to use a Lycoming XH-2470 twenty-four-cylinder H-type liquid-cooled engine with exhaust-driven turbo-supercharger and contra-rotating airscrews, but this experimental engine was abandoned in favour of a Wright R-3350-16 radial air-cooled engine with turbo-supercharger and driving two Curtiss Electric three-blade contra-rotating airscrews. The XF14C-2 was one of the first naval aircraft to be designed for this type of engine installation.

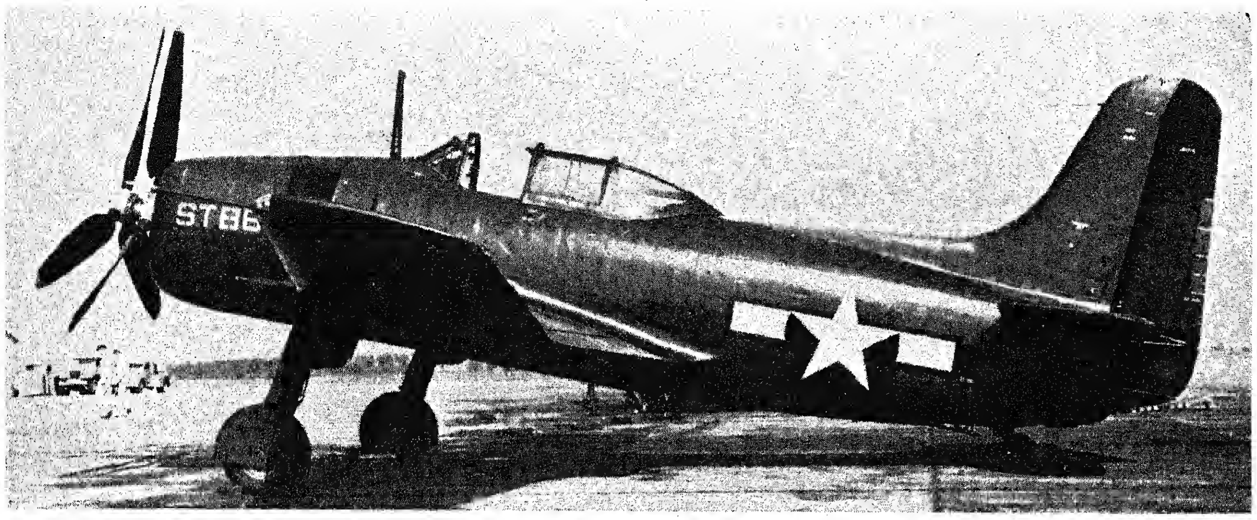
The aircraft had inward-retracting landing-gear, upward-folding wings, an armament of four wing-mounted 20 m/m. cannon and provision under the outer wings for carrying rockets or bombs.

THE CURTISS XBT2C-1

The XBT2C-1 is an experimental Bomber-Torpedo monoplane which is a progressive development of the SB2C-5 incorporating the well-tried features of war-time carrier-based aircraft and conforming to the latest tactical requirements for aircraft of this type.



The Curtiss XBT2C-1 Bomber-Torpedo Monoplane (Wright R-3350-24 engine).



The Curtiss XBTC-2 Experimental Torpedo-Bomber (Pratt & Whitney R-4360-8A engine).—(*Edgar Diegen*).

It is basically a single-seater but there is provision for a radar operator in an auxiliary seat located within the fuselage aft of and below the pilot for use on special radar scout missions.

Ten XBT2C aircraft have been delivered to the U.S. Navy for experimental test and service trials.

Type.—Single or two-seat Bomber-Torpedo Carrier.

Wings.—All-metal cantilever mid-wing monoplane. Aerofoil section NACA 23017 at roots tapering to NACA 23009 at tips. Wing built in three sections consisting of centre-section and two outer sections. Straight leading-edge and sharply-tapered trailing-edge. All-metal ailerons with trim-tab in starboard and trim and balance-tabs in port surface. Perforated split dive-flaps in two sections each side between ailerons and fuselage. Wings fold upwards from centre-section and almost meet on centre-line above fuselage. Mean aerodynamic chord 9 ft. 1.7 in. (2.79 m.), Wing area 416 sq. ft. (38.65 sq. m.).

Fuselage.—All-metal structure of oval cross-section.

Tail Unit.—Monoplane type. All-metal cantilever structure with metal covering. Trim tabs in statically-balanced rudder and elevators.

Landing Gear.—Retractable two-wheel type. Main wheels each carried on single compression leg attached to front spar near extremities of centre-section which retract inwards towards fuselage. 32 × 8.8 tyres. Wheel track 16 ft. 0 in. (4.87 m.). Non-retractable tail-wheel, with $8\frac{1}{2} \times 4$ tyre. Telescopic deck-arrester hook in extreme stern of fuselage below rudder.

Power Plant.—One Wright R-3350-24 eighteen-cylinder two-row radial air-cooled engine fitted with engine-driven cooling fan and driving Hamilton Standard 6559A-18 four-blade constant-speed airscrew, 13 ft. 8 in. (4.16 m.) diameter.

Accommodation.—Pilot's cockpit mounted above fuselage in line with leading-edge of wing. Fixed windshield has flat bullet-proof windscreen. Moulded bubble canopy slides for access. Provision for radar operator in auxiliary seat in fuselage aft of and below pilot for use on special duties.

Armament.—Two 20 m/m. cannon mounted in centre-section, one on each side of fuselage and outside airscrew disc. Bomb-bay approximately 14 ft. 3 in. (4.34 m.) long under wing has accommodation for full-size torpedo, variety of bombs, or large rocket-propelled bomb. Racks under wings for bombs or rocket projectiles.

Dimensions.—Span 47 ft. $7\frac{3}{32}$ in. (14.5 m.), Width folded 22 ft. $6\frac{1}{2}$ in. (6.87 m.), Length (tail up) 38 ft. $8\frac{11}{32}$ in. (11.79 m.), Height (on ground, over rudder) 12 ft. 1 in. (3.68 m.), Height folded 16 ft. $7\frac{13}{16}$ in. (5.07 m.), Maximum height during folding 20 ft. $6\frac{5}{8}$ in. (6.27 m.).

Weight Loaded (With torpedo).—Over 18,000 lbs. (8,165 kg.).

Performance.—No data available.

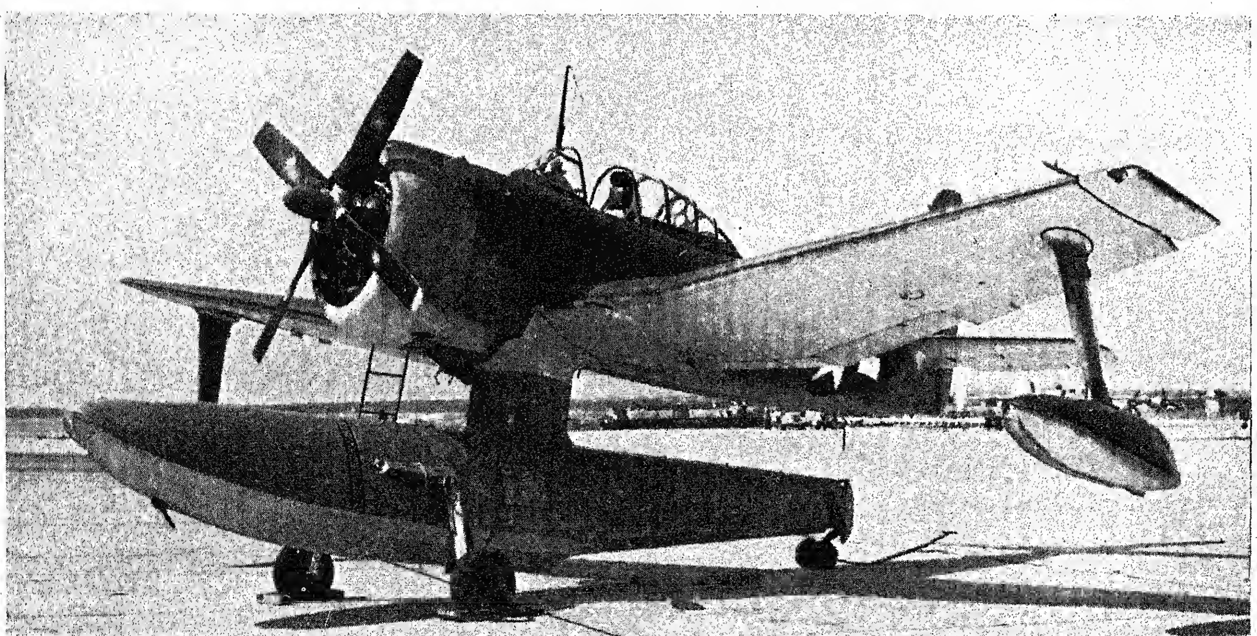
THE CURTISS XBTC-2.

The XBTC-2 was developed in 1943 as a single-seat Torpedo-Bomber but a change in battle tactics and the need for the carriage of a second crew-member as a radar operator resulted in the aircraft being superseded by the XBT2C-1. The XBTC-2 is fitted with a Pratt & Whitney R-4360-8A engine driving two three-blade contra-rotating airscrews. The general arrangement of this aircraft can be gathered from the accompanying illustration.

THE CURTISS SEAHAWK.

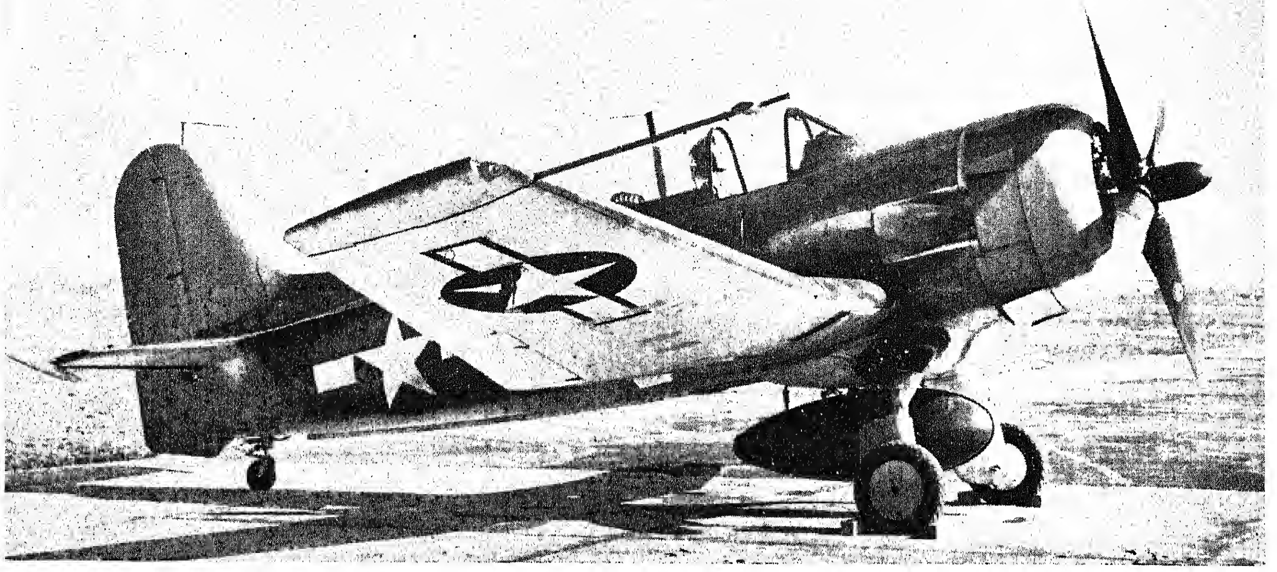
U.S. Navy designation : SC-1 and SC-2.

The development of the Seahawk began in June, 1942, when the U.S. Navy Bureau of Aeronautics invited the Curtiss company to submit proposals for an improved scout seaplane to replace the Kingfisher and Seamew. The Curtiss proposals were submitted on August 1 and on the 25th of that month a contract was placed with the company for seven aircraft, two experimental models for flight testing and five additional aircraft for equipment and service testing.



.The Curtiss SC-1 Seagull Single-seat Shipborne Scout (Wright R-1820-62 engine).—(*Edgar Diegan*).

CURTISS—*continued.*



The Curtiss SC-2 Seahawk Two-seat Shipborne Scout (Wright R-1820-68 engine).—(*Martin & Kelman*).

The first XSC-1 flew on February 16, 1944, and by April 28 all seven experimental aircraft had flown. The Seahawk was developed by and was produced at the Curtiss Columbus plant. It was first reported in action with the U.S. Fleet in the pre-invasion bombardment of Borneo in June, 1945.

The SC-1 is the original single-seat Seahawk, to which the specification below refers. It is standard equipment for catapult-equipped battleships and cruisers. The specification below refers to this model.

The SC-2 is a two-seat version with wider utility for scouting and rescue work. A limited number was delivered to the U.S. Navy in 1946. Externally, the SC-2 differs from the SC-1 in the following features; circular forward fuselage and cowling instead of oval; free-blown instead of framed canopy; rudder of higher aspect ratio and extending below bottom line of fuselage; horn-balanced elevators and anti-spin extensions to tailplane; radio mast re-located on port side of fuselage instead of windscreen frame; exhaust outlets in sides of fuselage instead of below; and cowling gills of greater chord. The SC-2 may also be fitted with wing rocket gear and there is provision for the installation of photographic reconnaissance equipment.

Type.—Single or two-seat Shipborne Scout.

Wings.—Low-wing cantilever monoplane. Rectangular centre-section with dihedral. Outer sections have taper and dihedral with square detachable wing-tips. Wings fold back for shipboard stowage. All-metal stressed-skin structure. Full-span automatic leading-edge slots. Slotted flaps inboard of ailerons.

Fuselage.—All-metal stressed-skin structure of circular section forward and changing to oval section aft.

Tail Unit.—Cantilever monoplane type. All-metal structure. Trim-tabs in elevators and rudder.

Floats.—Central single-step float on streamline pedestal mounting and two wing-tip stabilising floats on single cantilever struts. Main float accommodates bomb load or auxiliary fuel tanks. Wheel landing-gear for ferrying operations may replace float gear, the same attachment points being used for both gears. Catapult points and hook under nose of main float for net pick-up.

Power Plant.—One Wright R-1820-62 nine-cylinder radial air-cooled engine driving a Curtiss electrically-operated airscrew with four hollow steel paddle-type blades. Fuel tanks in centre-section. Auxiliary tanks may be carried in the main float.

Accommodation.—Pilot's cockpit over wing with sliding blister-type canopy. For sea-rescue work a bunk can be fitted in the fuselage aft of the pilot's seat into which a man can crawl.

Armament.—Two .5 in. (12.7 m/m.) machine-guns in the centre-section, one on each side of the fuselage. Bombs or depth-charges may be carried in the central float, which has bomb-doors controllable from the pilot's cockpit.

Dimensions.—Span 41 ft. (12.5 m.), Length 36 ft. 5 in. (11.1 m.).

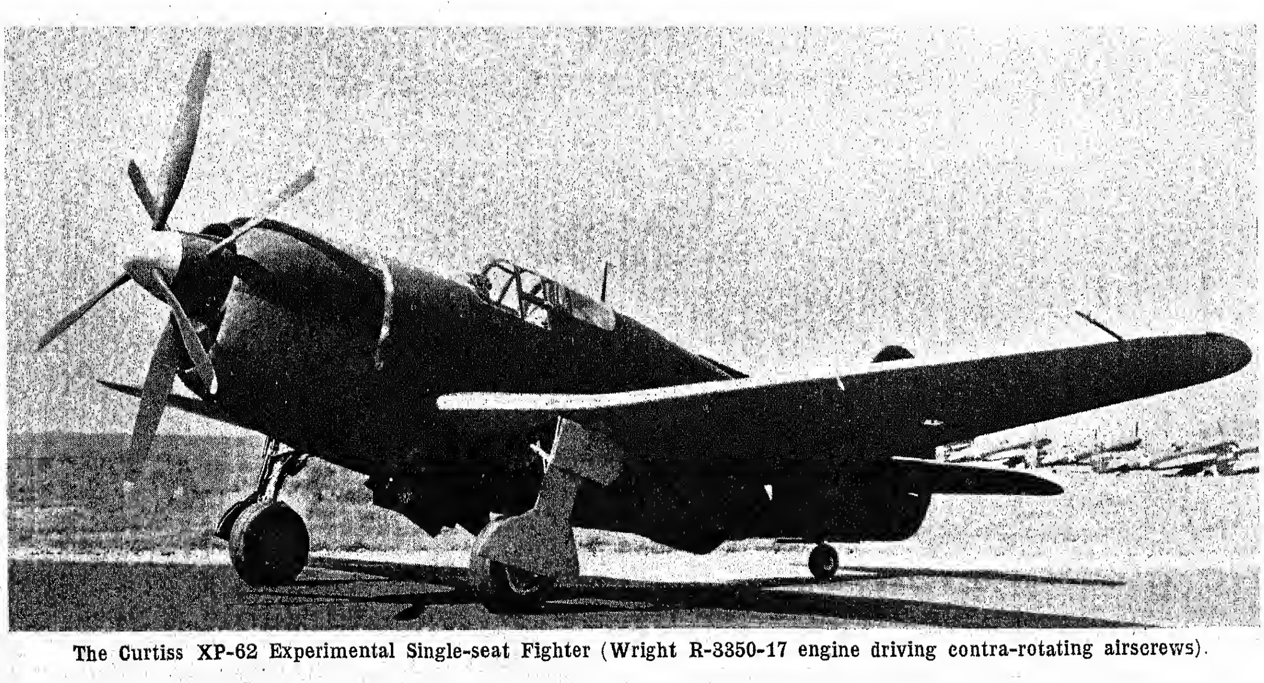
Weights.—No data available.

Performance.—Maximum speed 313 m.p.h. (513 km.h.) at 28,600 ft. (8,650 m.).

THE CURTISS XP-87.

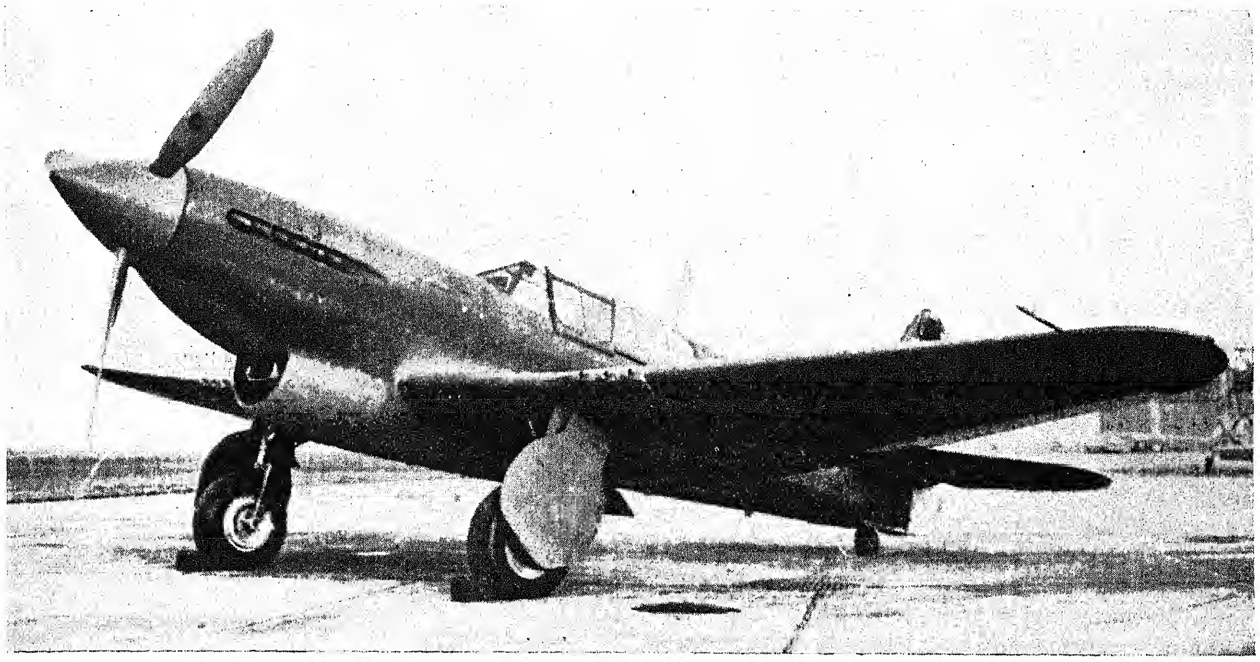
The XP-87 is a twin-engined "all-weather" fighter, intended for operations in conditions where visual contact with the enemy is impossible, which is under development for the U.S.A.A.F. It is a low-wing cantilever monoplane of all-metal construction and is fitted with two wing-mounted jet units in elongated nacelles.

The pilot's cockpit is located in the nose of the fuselage well ahead of the wings and engine nacelles. A heavy forward-firing armament is carried with the guns mounted on each side of the cockpit. No further details are available.



The Curtiss XP-62 Experimental Single-seat Fighter (Wright R-3350-17 engine driving contra-rotating airscrews).

CURTISS—*continued.*



The Curtiss XP-60D Experimental Single-seat Fighter (Packard V-1650-3 Merlin engine).

THE CURTISS XA-43.

The XA-43 is an Attack-Bomber which is virtually a four-jet version of the XP-87. The four jets are paired in single flat-shaped nacelles, one on each side of the fuselage. No further details are available for publication.

THE CURTISS XP-62.

The XP-62 was a single-seat Fighter-Bomber development from the XP-60 Series. It was fitted with a Wright R-3350-17 radial air-cooled engine with a single-stage variable-speed turbo-supercharger and driving two three-blade contra-rotating airscrews. It was provided with a pressure-cabin and apart from a heavy cannon armament, it had provision for carrying a 1,000 lb. (454 kg.) bomb load. The XP-62 was the largest and heaviest single-seat fighter built by Curtiss.

THE CURTISS XP-60 SERIES.

The XP-60 was designed as an improved version of the P-40 Warhawk but a number of variations were produced under this designation to test different power-plant installations with the result that five distinct prototypes were evolved.

The original XP-60 had a modified P-40 fuselage, laminar-flow wings, an inwardly-retracting landing-gear and was fitted with a Packard Merlin V-1650-1 engine driving a Curtiss three-blade airscrew. The armament originally projected for this aeroplane was to consist of eight .5 in. (12.7 m/m.) machine-guns, all mounted in the wings. This armament was reduced to four guns in subsequent models. The XP-60 was later fitted with a Merlin V-1650-3 two-speed two-stage supercharged engine driving a four-blade airscrew and was re-designated the XP-60D.

The XP-60A was fitted with an Allison V-1710-75 engine and turbo supercharger. This installation resulted in the provision of a bulkier fuselage with the radiator scoop moved forward under the engine crankcase. A YP-60A was projected with a Pratt & Whitney R-2800 two-stage supercharged radial air-cooled engine but this version was eventually completed as the XP-60E.

The XP-60B was to have been a modification of the Allison-engined XP-60A with a different type of turbine supercharger but it was never built.

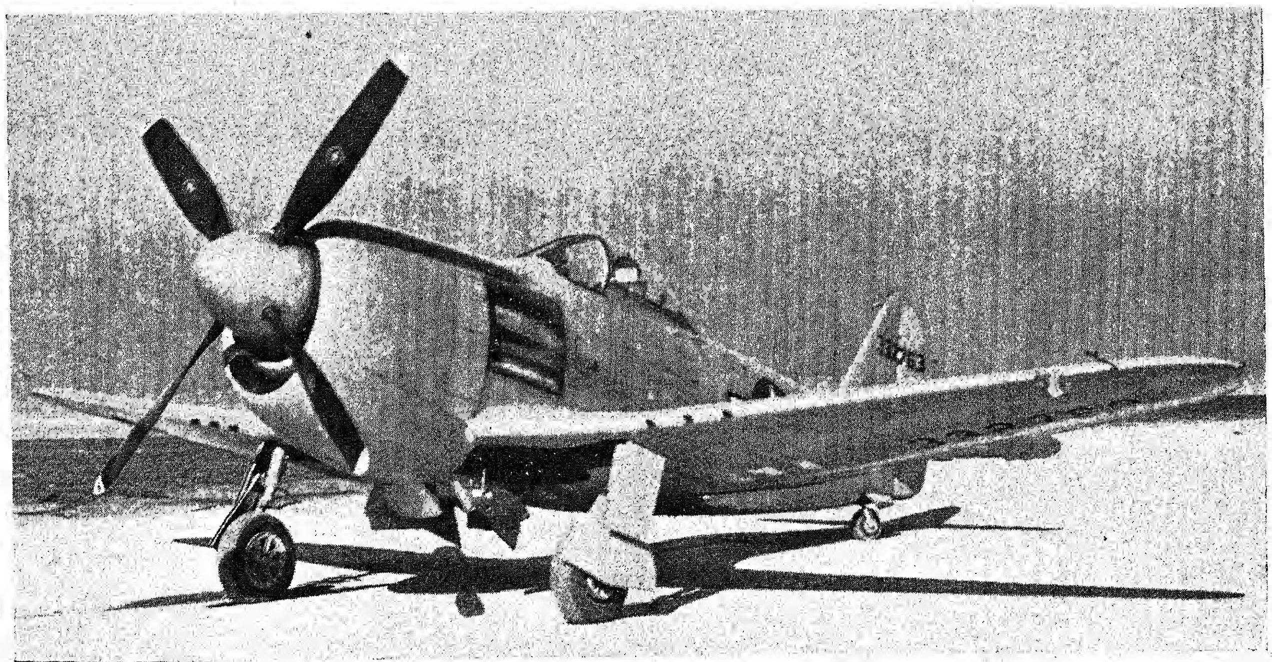
The XP-60C had the same airframe as the 60A but was fitted with a Pratt & Whitney R-2800 two-row radial engine driving two three-blade co-axial contra-rotating airscrews.

The XP-60E signalised a return to the single-rotation four-blade airscrew, this model being the re-designated YP-60A mentioned above. It was followed by the YP-60E, which was fitted with a blister-type canopy.

Dimensions.—Span 41 ft. 5 in. (12.6 m.), Wing area 275 sq. ft. (25.5 sq. m.).

Weight Loaded.—Over 10,000 lbs. (4,542 kg.).

Performance.—No data available.



The Curtiss YP-60E Experimental Single-seat Fighter (Pratt & Whitney R-2800-18 engine).

DOMAN-FRASIER.

DOMAN-FRASIER HELICOPTERS, INC.

Head Office: New York City, N.Y.
Established: August 31, 1945.
President and Chief Engineer: Glidden S. Doman.
Vice-President and Secretary: Gerald F. Finley.
Vice-President and Treasurer: Clinton W. Frasier.
Pilot-Consultant: Robert L. Nields.
Chief Rotor Group Engineer: Harry L. Brown.
Executive Engineer: Thomas E. Zeerip.

Doman-Frasier Helicopters, Inc., has been formed to produce a helicopter embodying new principles established by its engineers. Design of the LZ-1 demonstrator has been completed and development of the HC-1 commercial helicopter proceeds.

THE DOMAN-FRASIER LZ-1.

The LZ-1 two-seat helicopter was designed with the sole purpose of providing a demonstration aircraft, and one that could be flown for the purpose of obtaining documentary evidence of the low vibratory stress levels which result from the specialized rotor design. Construction was scheduled to begin in the Spring of 1946.

Type.—Two-seat helicopter.

Rotors.—One four-blade main rotor 36 ft. 0 in. (10.97 m.) diameter and one three-blade vertical controllable-pitch anti-torque and steering rotor 6 ft. 6 in. (1.98 m.) diameter, carried on outrigger extension of fuselage, both rotors driven by a single engine. Main rotor has ply-covered blades and chord of 1 ft. 3.6 in. (.33 m.) and rotates at 230 r.p.m. Rear rotor rotates at 1,500 r.p.m. at cruising speed.

Fuselage.—Welded steel-tube structure with covering of fabric and sheet metal.

Landing Gear.—Fixed tricycle type, main wheels carried on cantilever legs projecting outwards and backwards, and nose-wheel carried in fork.

Power Plant.—One 175 h.p. Franklin six-cylinder horizontally-opposed air-cooled engine mounted in fuselage aft of cabin. Cooling air inlet consists of horizontal louvres in nose. Fuel capacity 30 U.S. gallons (131 litres).

Accommodation.—Seats for two side-by-side in enclosed cabin.

Dimensions.—Main rotor diameter 36 ft. 0 in. (10.97 m.).

Weights and Loadings (Estimated).—Weight empty 1,550 lbs. (703 kg.), Weight loaded 2,050 lbs. (930 kg.), Rotor disc loading 2.01 lbs./sq. ft. (9.8 kg./sq. m.), Power loading 11.7 lbs./h.p. (5.3 kg./h.p.).

Performance (Estimated).—Maximum speed 110 m.p.h. (177 km.h.) at sea-level, Cruising speed 85 m.p.h. (137 km.h.) at sea-level, Initial climb 2,000 ft./min. (609 m/min.), Service ceiling 15,000 ft. (4,570 m.), Hovering ceiling 6,500 ft. (1,980 m.), Normal range 238 miles (383 km.).

THE DOMAN-FRASIER HC-1.

The HC-1 is a projected ten-passenger helicopter for commercial use, and in lay-out is similar to the LZ-1 two-seat model, having a main four-blade rotor 63 ft. 0 in. (19.2 m.) in diameter and a small vertical rotor on an outrigger. The main rotor rotates at 150 r.p.m. The HC-1 is to be powered by two Wright 735 C7BA1 seven-cylinder radial air-cooled engines, one developing 800 h.p. at 2,600 r.p.m. from sea-level to 3,500 ft. (1,065 m.), and one developing 318 h.p. at 1,600 r.p.m. from sea-level to 12,000 ft. (3,660 m.). The gross weight is 8,900 lb. (4,037 kg.), which includes a pay-load of 2,200 lb. (988 kg.).

Performance (Estimated).—Cruising speed 95 m.p.h. (153 km.h.), Service ceiling 17,000 ft. (7,710 m.), Hovering ceiling 6,000 ft. (2,720 m.).

DOUGLAS.

THE DOUGLAS AIRCRAFT COMPANY, INC.

Head Office and Works: Santa Monica, California.
Other Works: El Segundo and Long Beach, Cal.
Established: 1920. (Reorganized: 1928.)
President: Donald W. Douglas.
Vice-President—Manufacturing: Frederick W. Conant.
Vice-President—Engineering: A. E. Raymond.
Vice-President—Comptrolling: R. V. Hunt.
Vice-President—Domestic Military Sales: J. M. Rogers.
Vice-President—Domestic Sales: Nat Paschall.
Executive Secretary: T. C. McMahon.
Treasurer: H. P. Grube.

The Douglas Aircraft Company has occupied the present factory site at Clover Field, Santa Monica, Cal., since 1928. It also operates plants at El Segundo, Cal., nine miles from the main plant, and at Long Beach, Cal. During the war other plants were operated at Tulsa, Okla., Chicago, Ill., and Oklahoma City, Okla.

During the four years of America's participation in the war the Douglas company produced a total of 29,385 aircraft for the armed forces of the U.S.A. and its Allies. This notable contribution to Victory was made up of 10,123 C-47 Skytrain and Skytrooper transports; 6,043 A-20 Havoc or Boston light bombers; 5,559 SBD Dauntless naval dive-bombers; 3,000 B-17 Fortress heavy bombers; 2,502 A-26 Invader light bombers; 1,162 C-54 Skymaster transports; 962 B-24 Liberator heavy bombers; and 34 various experimental aircraft. To this must be added a further 1,883 combat and transport aircraft delivered to the U.S. forces and to the British and French Governments in 1940 and 1941 before America entered the war.

With a production area of less than 2,000,000 sq. ft. at the end of 1941, the plants owned and operated by the company were expanded to a total of 14,750,000 sq. ft. by the end of the war, and employment rose from an average of 28,600 in 1941 to 157,200 at the peak in August, 1943. By the end of 1945 this figure had fallen to about 27,000.

Large-scale cancellations of contracts, amounting in value to $870 million, followed the cessation of hostilities in Europe, and other contracts, valued at $635 million, were cancelled abruptly within a few hours of final victory over Japan. All contracts for military combat aircraft were terminated at that time but considerable quantities of material and work in progress on terminated C-47 and C-54 contracts which were adaptable to the commercial DC-3 and DC-4 airliners were purchased by the company for conversion and sale to airlines at home and overseas.

The DC-6, a development of the DC-4, was designed during the later stages of the war and the prototype, under the Army designation XC-112A, first flew in February, 1946. It is now in production for post-war civil use.

The C-74, the largest four-engined transport built during the war, flew for the first time in September, 1945, and was approaching the quantity production stage at the time war contracts were cut back. This aircraft was also being featured as a post-war commercial aircraft as the DC-7 and a contract had been received in 1945 for a series of this type from Pan American Airways. The reduction of the military contract for the C-74 also resulted in the Pan American order for the DC-7 being cancelled. Fourteen C-74 military transports have been completed for the U.S. Army.

The most spectacular Douglas wartime development was the XB-42 bomber with two liquid-cooled engines installed in the fuselage and driving contra-rotating propellers located aft of the tail-unit through shafts. This aircraft flew for the first time in June, 1944.

The prototype Douglas XC-74 Military Transport (four 3,000 h.p. Pratt & Whitney R-4360-27 Wasp-Major engines).

***DOUGLAS**—continued.*

The Douglas XC-112A Military Transport Monoplane, which is also the prototype of the Commercial DC-6 (four Pratt & Whitney R-2800CA-15 Double Wasp engines).

In the meantime, a further development of the "buried" power-plant formula is exemplified by the XB-43, which is generally similar to the XB-42 except that it is fitted with two jet-propulsion units exhausting aft of the tail.

For the U.S. Navy, the Douglas company concentrated mainly on the development of the Scout/Dive Bomber. To find a successor to the SBD Dauntless, which was in production up to July, 1944, the company produced a number of experimental aircraft in this class. In the Spring of 1943 a new two-seat aeroplane—the XSB2D-1—was completed but changing naval tactics dictated that the SB2D be modified into a single-seat bomber, the BTD-1. By June, 1944, battle conditions in the Pacific had again altered and an entirely new design—the BT2D—was called for. First designs for this aeroplane were submitted to the U.S. Navy in July, 1944, engineering was completed 5½ months later, and the prototype XBT2D-1 was ready to fly 8½ months after the design was submitted. The BT2D-1 was too late to participate in the war but under a new AD-1 designation it will be used to re-arm the U.S. Navy's post-war carrier fleets.

THE DOUGLAS DC-7 GLOBEMASTER.

U.S. Army Air Forces designation: C-74.

The Globemaster is a large four-engined transport which, following the cancellation of an order for twenty-six placed by Pan-American World Airways in 1945, now only exists in military form. The prototype, designated the XC-74, made its first flight on September 5, 1945, at Long Beach, California. The original military contract for this aircraft was cut back when the war ended but fourteen have been completed for the U.S. Army.

TYPE.—Four-engined Military transport.

WINGS.—Cantilever low-wing monoplane. Low-drag laminar flow aerofoil section. All-metal two-spar structure in three main sections consisting of centre-section and two outer wings. Longitudinal hat-section stringers and stressed metal skin. Centre-section span 101 ft. 8 in. (30.99 m.). Full-span Fowler-type flaps, outer sections of which act as ailerons, with faired control hinges under wing.

FUSELAGE.—Monocoque structure of circular cross-section, with vertical frames, longitudinal stringers and stressed metal skin. External diameter 13 ft. 2 in. (4.01 m.).

TAIL UNIT.—Cantilever monoplane type. All-metal structure with stressed skin over fin and tailplane and fabric covering to statically-balanced rudder and elevators. Trim-tab in rudder and trim and balance-tabs in elevators. Tailplane span 53 ft. 0 in. (16.15 m.).

LANDING GEAR.—Retractable tricycle type, each main unit consisting of a single compression leg carrying two wheels which retract forward into inner engine nacelles. Twin nose-wheels carried on single compression strut retract forward into fuselage. Track (centre-lines of legs) 34 ft. 2 in. (10.41 m.), Wheel base 37 ft. 3 in. (11.35 m.). Emergency bumper skid under rear fuselage.

POWER PLANT.—Four Pratt & Whitney Wasp Major R-4360 twenty-eight-cylinder four-row radial air-cooled engines developing 3,000 h.p. for take-off and enclosed in long-chord tapered cowlings with controllable trailing-edge gills. Hamilton-Standard three-blade full-feathering and reversible or Curtiss-Electric four-blade full-feathering airscrews. Entry doors in wing root and in each nacelle allow inspection of engines in flight. Maximum fuel capacity 11,000 U.S. gallons (41,532 litres) carried in six integral tanks in centre-section.

ACCOMMODATION.—Crew of thirteen. Crew compartment divided into two decks. Pilot's cockpit with twin blister fairings on upper deck, with compartment immediately behind for flight-engineer, radio-operator and navigator, together with galley and crew lavatory. Relief crew compartment on floor below with hatch and ladder connection and bunks for six persons. Crew entry door in floor of relief compartment. Main cabin 75 ft. long × 11 ft. 6 in. wide × 8 ft. 6 in. high (22.86 × 3.50 × 2.59 m.) has floor area of approximately 875 sq. ft. (81.28 sq. m.). Floor covered with 20 in. (50.8 cm.) grid pattern of heavy-duty tie-down rings. Maximum floor loading 200 lbs./sq. ft. (976 kg./sq. m.). Lower cargo deck below main cabin floor reached by hatches. Two travelling cranes, each lifting 8,000 lbs. (3,629 kg.) or 16,000 lbs. (7,258 kg.) together run length of main cabin on rails. Section of main cabin floor forms freight elevator aft of trailing-edge and is operated by cranes. Side door hoist lifting 4,500 lbs. (2,041 kg.) located near main cargo door towards front of fuselage. Self-loading equipment can load and stow ten R-3350 engines and cradles, fifteen V-1710 engines and cradles; or two T-9E1 tanks, two 75 m/m. or 105 m/m. howitzers with tractors, ammunition carriers and crews; combinations of 1½ ton trucks, jeeps, ammunition trucks, 90 m/m. A.A. guns, or three complete P-39 or two complete P-47 or similar type aircraft broken down into their main components. Seats for 125 troops or 115 stretchers can be installed.

DIMENSIONS.—Span 173 ft. 2 in. (52.78 m.), Length 124 ft. 1½ in. (37.83 m.), Height 43 ft. 8 in. (13.31 m.).

WEIGHT LOADED.—162,000 lbs. (73,482 kg.).

PERFORMANCE (Approximate).—Cruising speed 300 m.p.h. (483 km.h.), Maximum range 7,800 miles (12,553 km.).

THE DOUGLAS DC-6.

U.S. Army Air Forces designations : XC-112A.

The DC-6 is a larger and slightly more powerful development of, and successor to, the DC-4. Compared with the DC-4 it has a larger fuselage and a more powerful engine installation and included among its features are pressurised cabins for crew and passengers ; roomier cabin, seats and berths ; reversible-pitch airscrews and thermal de-icing for wings, tail and wind shield. The DC-6 is in production for many U.S. airlines and deliveries were due to begin in the Spring of 1947.

The military transport version of the DC-6 carries the designation XC-112A. Except for the internal accommodation, which conforms to military requirements, the XC-112 is identical to the DC-6 and has the same performance and flight characteristics. The first flight of the XC-112A the prototype of the DC-6, took place at Clover Field, Santa Monica, Cal., on February 15, 1946.

TYPE.—Four-engined Commercial or Military transport.

WINGS.—Similar to DC-4. Fitted with thermal de-icing equipment.

FUSELAGE.—Structure as for DC-4 but overall length increased to 100 ft. 7 in. (30.66 m.).

TAIL UNIT.—Structure as for DC-4 but surfaces increased in area. Fin area 93.4 sq. ft. (8.67 sq. m.), Rudder area (aft of hinge, with tab) 49 sq. ft. (4.55 sq. m.), Total vertical area 159.9 sq. ft. (14.86 sq. ft.), Tailplane area 362.5 sq. ft. (33.67 sq. m.), Elevator area (aft of hinge, with tab) 108.9 sq. ft. (10.11 sq. m.).

LANDING GEAR.—Similar to DC-4. Track 24 ft. 8 in. (7.52 m.). Wheel base 30 ft. 8 in. (9.34 m.).

POWER PLANT.—Four Pratt & Whitney Double-Wasp R-2800CA-15 eighteen-cylinder two-row radial air-cooled engines, each normally rated at 1,800 h.p., and with 2,100 h.p. available for take-off. Curtiss Electric or Hamilton Standard three-blade constant-speed full-feathering and reversible airscrews 13 ft. 1 in. (3.98 m.) diameter. Normal fuel capacity 2,577 U.S. gallons (9,730 litres), Maximum capacity (with additional collapsible cell-type inner wing tanks) 4,201 U.S. gallons (14,561 litres).

ACCOMMODATION.—Pressurised accommodation for crew and passengers. Passenger compartment seats 52 by day and for short-range can accommodate up to a maximum of 68. Entrance vestibule with coat-room and galley aft of wings with cabin space fore and aft. Seats in pairs on either side of central gangway ; adjustable

DOUGLAS—*continued.*

tables may be fitted between seats. Upper and lower berths for twenty-six passengers may be fitted up in 30 seconds. Upper berths have separate air-conditioning controls. All berths have reading lights and storage space for clothing and toilet accessories. Men's lounge and toilet forward of main cabin, ladies' lounge etc. aft of main cabin. Entire cabin space has fibre-glass sound-proofing and floors covered with foam-rubber-backed carpets. Pressurisation ensures cabin pressure altitude of approximately 5,000 ft. (1,525 m.) when flying at 16,000 ft. (4,880 m.), or 8,000 ft. (2,440 m.) when flying at 20,000 ft. (6,100 m.). Passenger cabin dimensions 64 ft. (19.5 m.) long, 7 ft. 3 in. (2.2 m.) high. All freight and baggage space below cabin floor with new handling facilities to permit quick loading and unloading.

Dimensions.—Span 117 ft. 6 in. (35.81 m.), Length 100 ft. 7 in. (30.66 m.), Height (overall) 28 ft. 5 in. (8.66 in.).

Weights and Loadings.—Normal loaded weight 84,000 lbs. (38,101 kg.), Maximum loaded weight (with maximum fuel) 93,200 lbs. (42,274 kg.), Designed landing weight 73,000 lbs. (33,113 kg.), Wing loading (at normal loaded weight) 57.4 lbs./sq. ft. (280.23 kg./sq. m.), Power loading (at take-off, normal loaded weight) 10 lbs./h.p. (4.53 kg./h.p.).

Performance (at normal loaded weight).—Maximum cruising speed 302 m.p.h. (486 km.h.) at 19,400 ft. (5,913 m.), Cruising speed (60% power) 265 m.p.h. (426 km.h.) at 10,000 ft. (3,050 m.), Maximum range (normal fuel) 2,560 miles (4,120 km.) at 10,000 ft. (3,050 m.), Range (maximum fuel) 3,930 miles (6,324 km.) at 10,000 ft. (3,050 m.).

THE DOUGLAS DC-4 SKYMASTER.

U.S. Army Air Forces designation: C-54.

U.S. Navy designation: R5D.

The design of the original DC-4 was developed by the Douglas Company in collaboration with the technical departments of five of the biggest airline companies in the United States. The prototype received its Approved Type Certificate in May, 1939, and it was then submitted to prolonged service tests under the supervision of United Air Lines. The first model was fitted with four 1,150 h.p. Pratt & Whitney R-2180 Twin-Hornet engines and had accommodation for 52 passengers. It was eventually sold to Japan and subsequently crashed.

On the basis of service tests a new and slightly scaled-down design was prepared for production with accommodation for 40-42 passengers and fitted with four 1,100 h.p. Pratt & Whitney R-2000 Twin-Wasp engines. In 1941 production of provisional orders for sixty aircraft of this type was slowed down owing to defence needs but later in the year the DC-4 design was converted to meet U.S. Army specifications, redesignated C-54, and ordered in large quantities as a long-range military transport.

The first production C-54 flew early in 1942 without experimental prototype.

The Skymaster is still the standard four-engined transport in the U.S. Army and Navy air services, but large numbers, mainly of the C-54B and C-54E models, have been sold out of the service for conversion to civil use. Converted C-54Es were used by Pan American World Airways, American Overseas Airlines and T.W.A. to survey and inaugurate their trans-Atlantic landplane services to Europe after the war.

C-54. Four 1,100 h.p. Pratt & Whitney R-2000-3 radial engines. The original military conversion of the DC-4. Did not have the heavy-duty floor and floor support structure found in the later models in the C-54 Series. No large cargo door or facilities for handling military cargo. Main cabin had seats for 26 passengers. Fuel compartment in fuselage housed four fuel tanks to augment the standard wing tanks. Fuel capacity 3,580 U.S. gallons (13,550 litres).

C-54A (R5D-1). Four 1,100 h.p. Pratt & Whitney R-2000-7 engines. Structurally re-designed to provide for carrying heavy cargo. Large cargo-loading door cut in fuselage aft of wings, floor and floor supporting structure strengthened to support heavy items of freight and twin-boom hoist and winch installed to load and unload cargo and ordnance. Provision for suspension beneath fuselage of items of heavy equipment the size and weight of which would prevent them from being loaded in the cabin. Cabin designed to be rapidly converted for carrying cargo or troops, or for the evacuation or transport of wounded. Fuel capacity 3,620 U.S. gallons (13,703 litres).

C-54B (R5D-2). Four 1,100 h.p. Pratt & Whitney R-2000-7 engines. Development of C-54A. Chief structural change consisted of the removal of two fuselage fuel tanks and installation of integral fuel tanks of comparable capacity in outer wings. Standardisation of cabin interior fittings to permit rapid conversion from cargo transport or troop carrier. Removable stretcher fittings and individual oxygen outlets throughout the cabin. Fuel capacity 3,720 U.S. gallons (14,081 litres).

C-54C. One special Skymaster equipped for the personal use of the late President Roosevelt. Fitted with electrically-operated elevator, Presidential state-room, three other state-rooms, main cabin with conference table, etc. Crew of seven and fifteen passengers with sleeping accommodation for six.

C-54D (R5D-3). Cargo model with cabin interior similar to C-54B. Many improvements introduced in C-54E progressively incorporated in C-54D, including later installation of R-2000-11 engines.

C-54E (R5D-4). Four Pratt & Whitney R-2000-11 engines with better altitude performance. Combines passenger features of original C-54 with cargo facilities of C-54A and B. Remaining two fuselage tanks removed and additional collapsible tanks installed in wings. Twenty double passenger seats, ten on each side of central aisle, fit-on combination seat and cargo tie-down fittings. Detachable full-length baggage racks above windows. Buffet, toilet, lavatory and coat-room at aft end of cabin. Sound-proofing, heating and individual oxygen outlets. For cargo carrying, seats, carpets, baggage racks, etc. removed and floor covered with plywood covering. Fuel capacity 3,540 U.S. gallons (13,400 litres).

XC-54F. A modification of the C-54B incorporating special requirements of Troop Carrier Command. None built.

C-54G (R5D-5). Four Pratt & Whitney R-2000-9 engines. Except for power-plant similar to C-54E.

C-54H. Similar to XC-54F troop-carrier. Cancelled after VJ-Day.

C-54J (R5D-6). Same power-plant as C-54G. Personnel transport with full airline furnishings. No cargo facilities. Cancelled after VJ-Day.

XC-54K. One C-54E fitted with four 1,425 h.p. Wright R-1820 Cyclone engines.

XC-114. C-54 fitted with four 1,620 h.p. Allison V-1710-131 twelve-cylinder Vee liquid-cooled engines. One only.

XC-115. Project for C-54 fitted with four Packard V-1650-209 Merlin engines. Not built.

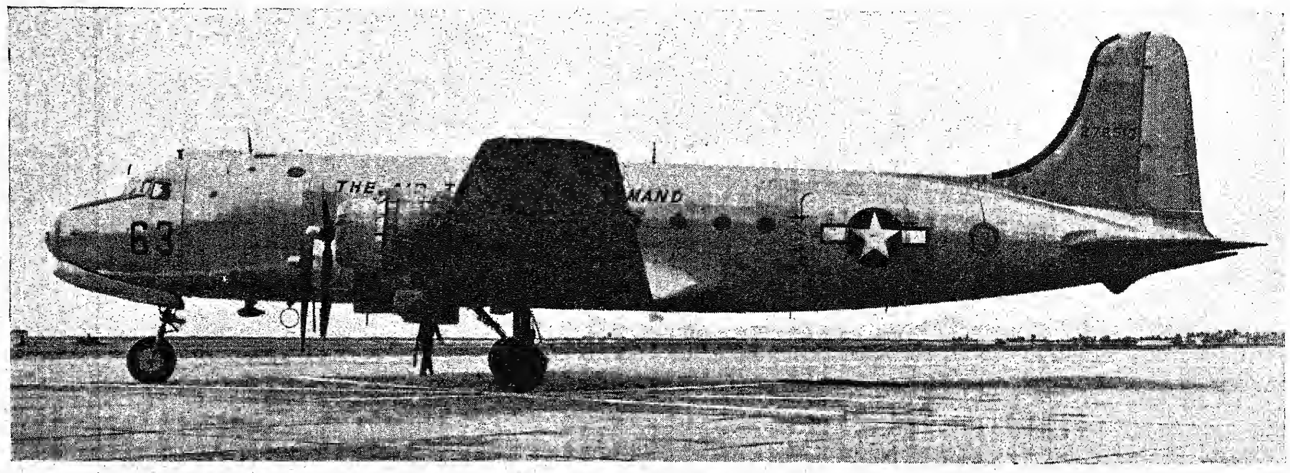
XC-116. Same as XC-114 but fitted with thermal de-icing for wings and tail.

Type.—Four-engined medium and long-range Troop or Cargo Transport.

Wings.—Low-wing cantilever monoplane with constant taper from roots to tips. Aerofoil section NACA 23016/23012. Incidence at root 4 degrees. Dihedral 7 degrees. Centre-section of three-spar construction, spars passing through the fuselage to which they are permanently attached. Self-sealing fuel tanks built integrally with structure. Outer wings have single main spar. Structure of centre-section and outer wings completed by former ribs, spanwise stringers and a smooth Alclad skin. Wing area 1,457 sq. ft. (135.35 sq. m.). NACA slotted flaps from fuselage to ailerons. Flap doors on wing undersurface are automatically retracted to permit smooth flow of air through slot when flaps are down. Both flaps and ailerons are single-spar metal structures. Controllable tab in starboard aileron.

Fuselage.—Semi-monocoque all-metal structure made up of a series of transverse frames, longitudinal stringers and a flush-riveted smooth Alclad skin.

Tail Unit.—Cantilever monoplane type. Fin and tailplane have two-spar frames and are covered with smooth Alclad sheet. Tailplane units have removable leading-edges and detachable tips, and are interchangeable from right to left or *vice-versa*. Rudder which is statically, aerodynamically and dynamically balanced



The Douglas C-54D Skymaster Military Transport (four Pratt & Whitney R-2000-11 Twin-Wasp engines).—(*William T. Larkins*).

***DOUGLAS**—continued.*

The Douglas DC-4 Four-engined Airliner (four 1,450 h.p. Pratt & Whitney Twin-Wasp engines).

by lead weights, has single channel spar and fabric covering. Elevators, with similar balances to rudder, have single-spar frames, metal leading-edges and overall fabric covering. Fin area: 90.5 sq. ft. (8.4 sq. m.), Rudder area (aft of hinge including tab) 47.3 sq. ft. (4.39 sq. m.), Total vertical area (including fin extension) 153.6 sq. ft. (14.26 sq. m.), Elevator area (aft of hinge line, including tabs) 86.1 sq. ft. (7.99 sq. m.), Total horizontal surface area 324.8 sq. ft. (30.17 sq. m.).

Landing Gear.—Retractable tricycle type. Each unit of main gear has twin-wheels and single shock-strut. Steerable nose wheel has single wheel. Hydraulic retraction, the main wheels being raised forward into inboard engine nacelles and the nose wheel forward into fuselage. Manual emergency gear. Automatic devices provided to prevent retraction while any load remains on the landing-gear. Dual hydraulic brakes on each main wheel.

Power Plant.—Four Pratt & Whitney R-2000-7 or 11 fourteen-cylinder radial air-cooled engines with two-speed superchargers, each rated at 1,100 h.p. to 7,000 ft. (2,135 m.), 1,000 h.p. from 7,000 to 14,000 ft. (4,270 m.) and with 1,350 h.p. available for take-off. Hamilton-Standard Hydromatic four-blade constant-speed full-feathering airscrews 13 ft. 2 in. (4 m.) diameter. Fuel tanks in fuselage and wings. Oil tank in each engine nacelle behind fireproof bulkhead. Auxiliary oil tank in fuselage.

Accommodation.—Crew of six, comprising pilot, co-pilot, navigator, radio-operator and two relief crew members. Flight compartment accommodates pilot and co-pilot side-by-side with dual controls, and navigator and radio-operator behind. Crew compartment aft of flight compartment provides accommodation for two relief crew members, and is provided with rest bunks, toilet, water tank and stowage for parachutes, life-raft, etc. Both these compartments are sound-proofed. In C-54 fuel compartment housing four fuel tanks follows crew compartment and is separated from main compartment by removable partition. Main compartment equipped with 26 seats, overhead baggage racks and stowage for four life-raft. Coatroom, buffet and food storage unit and lavatory and wash-room aft of main compartment. In C-54A main compartment re-arranged to provide troop benches instead of passenger seats. Flooring and floor beams strengthened to withstand heavy concentrated loads. Tie-down fittings for engines, ordnance and cargo installed throughout length of main cabin. Large loading door on starboard side 94 in. (2.38 m.) wide × 67 in. (1.7 m.) high, with provisions for attaching a platform and ramp for loading wheeled vehicles. Built-in twin-boom hoist capable of supporting 4,000 lbs. (1,814 kg.). Provision for removable stretcher installation and for stowage space for sea rescue equipment. Low-pressure continuous-flow oxygen system for pilot's and crew's compartments. In C-54B two of four tanks removed from fuselage and tanks of comparable capacity installed in outer wings. In C-54E remaining two tanks removed. Additional all-purpose floor fittings for passenger seats or troop benches. A demand-type oxygen supply system with individual outlets installed throughout main cabin. Improved hoist permits greater clearance and outreach for handling cargo or stretchers. Emergency exit doors in sides of fuselage over wings. Front (125 cub. ft.=3.53 cub. m.) and rear (165 cub. ft.=4.66 cub. m.) belly compartments beneath cabin floor with access from outside. Provision for carrying external loads under fuselage, such as airscrews, etc. Glider-towing cleat and release in aft end of tail-cone. Heating and ventilating system, full radio equipment, including marker beacon and radio compass, etc.

Dimensions.—Span 117 ft. 6 in. (35.8 m.), Length 93 ft. 11 in. (28.6 m.), Height 27 ft. $6\frac{5}{16}$ in. (8.4 m.).

Weights (C-54).—Weight empty 36,400 lbs. (16,526 kg.), Weight loaded 62,000 lbs. (28,150 kg.).

Weights (C-54A).—Weight empty 37,300 lbs. (16,934 kg.), Maximum loaded weight 65,000 lbs. (29,510 kg.), Maximum landing weight 62,000 lbs. (28,150 kg.).

Weights (C-54B).—Weight empty 38,200 lbs. (17,343 kg.), Maximum loaded weight 73,000 lbs. (33,142 kg.), Maximum landing weight 62,000 lbs. (28,150 kg.).

Performance—Maximum speed 274 m.p.h. (438 km.h.) at 14,000 ft. (4,270 m.), Cruising speed (maximum cruising power) 239 m.p.h. (382 km.h.) at 15,200 ft. (4,640 m.), Stalling speed (flaps in landing position) 88 m.p.h. (141 km.h.), Initial rate of climb 1,070 ft./min. (326 m./min.), Service ceiling 22,500 ft. (6,860 m.), Service ceiling (on three engines) 17,300 ft. (5,280 m.), Normal range (16,500 = 7,490 kg. cargo) 1,500 miles (2,480 km.) at 220 m.p.h. (352 km.h.) at 10,000 ft. (3,050 m.), Maximum range (5,400 lbs. = 2,450 kg. cargo) 3,900 miles (6,240 km.) at 190 m.p.h. (304 km.h.) at 10,000 ft. (3,050 m.).

THE DOUGLAS DC-4-1009.

The DC-4, now being delivered to airlines all over the World, is based on the C-54 Skymaster and incorporates many of the design features introduced into the military model.

Accommodation is provided for a crew of five and 44 passengers, baggage and freight for day use and 22 passengers, baggage and freight as a sleeper. Freight is carried in three compartments, one (135 cub. ft.=3.81 cub. m.) forward of the passenger compartment on the right side with a 5 ft. (1.52 m.), wide loading door and two beneath the cabin floor (120 cub. ft.= 3.39 cub. m. and 165 cub. ft.=4.66 cub. m.) with 2 ft. 6 in.×3 ft. (.76 × .915 m.) loading doors.

The basic design of the new DC-4 is such that cabin supercharging may be installed if desired. The general structure is the same as for the Skymaster.

Power Plant.—Four Pratt & Whitney Twin-Wasp 2SD13-G fourteen-cylinder two-row radial air-cooled engines with two-speed superchargers, each rated at 1,200 h.p. and with 1,450 h.p. available for take-off. Hamilton Standard Hydromatic constant-speed airscrews 13 ft. 1 in. (4 m.) diameter. All fuel tanks in wings. Normal fuel capacity 2,868 U.S. gallons (10,856 litres). Maximum fuel capacity (with alternate collapsible cell-type inner wing fuel tanks) 3,592 U.S. gallons (13,596 litres).

Dimensions.—As C-54.

Weights and Loadings.—Maximum gross take-off weight 73,000 lbs. (33,142 kg.), Maximum permissible landing weight 63,500 lbs. (28,830 kg.), Wing loading (maximum gross weight) 50.1 lbs./sq. ft. (244.5 kg./sq. m.), Power loading (maximum gross weight—take-off power) 12.7 lbs./h.p. (5.76 kg./h.p.).

Performance.—Cruising speed (maximum cruise power—high blower) 246 m.p.h. (393.6 km.h.) at 20,800 ft. (6,350 m.), Cruising speed (60% rated power) 227 m.p.h. (363 km.h.) at 10,000 ft. (3,050 m.), Absolute range (normal fuel—10% above speed for maximum L/D) 3,300 miles (5,280 km.), Absolute range (with inner wing fuel cells—10% above speed for maximum L/D) 4,250 miles (6,800 km.).

THE DOUGLAS DC-4-1037.

The DC-4-1037 is the specially-built cargo version of the previously-described DC-4-1009. The cargo hold has a volume of 3,691 cub. ft. (104.5 cub. m.) and a load capacity of 22,700 lbs. (10,306 kg.). A loading door 8 ft. × 5 ft. 6 in. (2.44 × 1.67 m.) is provided for the main hold. There are also four auxiliary compartments beneath the main hold floor for packaged freight, etc.

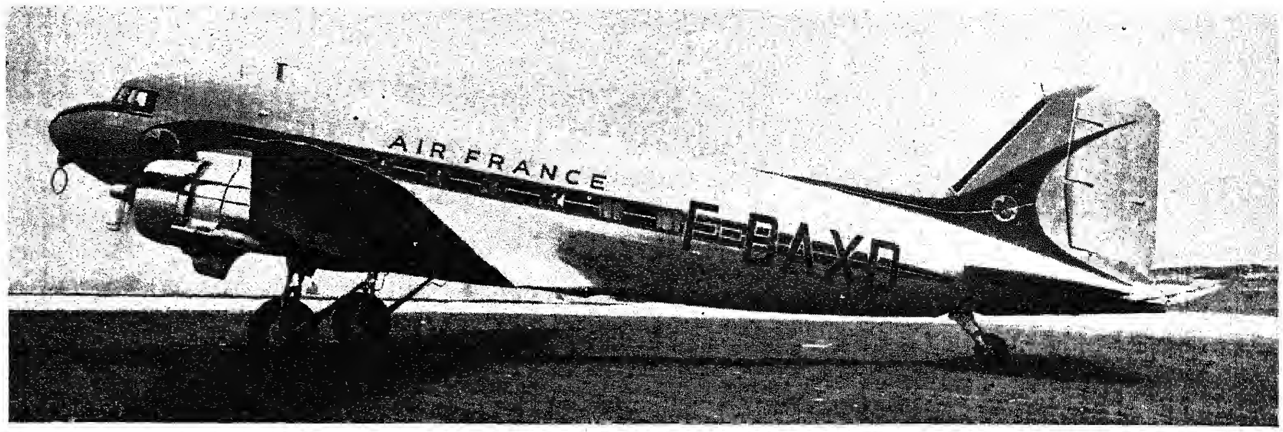
With a cargo capacity of 22,700 lb. (10,306 kg.) and a range of 1,500 miles (2,400 km.) the new DC-4-1037 can be operated at a lower cost than any other cargo aircraft, including even the DC-3 and the converted C-54.

THE DOUGLAS DC-3.

The most widely-used transport in the World, the DC-3 has now been withdrawn from production after 10,926 had been built, 10,123 as military transports under the designations C-47 and C-53.

The first DC-3 flew on December 18, 1935, and the first transport company to put the DC-3 into commercial service was

DOUGLAS—*continued.*



A Douglas DC-3 Commercial Airliner (two Pratt & Whitney Twin-Wasp engines).

American Airlines, in June, 1936. Before the war the DC-3 was standard equipment on the major U.S. airlines and on several foreign lines. During the war the DC-3 in military guise became the standard equipment in the Transport Commands of the Allied air forces, serving as cargo-carrier, paratroop carrier, personnel transport, glider-tug, ambulance, etc.

From the welter of variations created from the basic DC-3 transport there now emerge five identifiable civil types which are enumerated below, and a great number of non-standard converted military transports. Of the DC-3 types, the following are now in airline service :—

DC-3. Two Wright Cyclone R-1820 engines. Standard 21-passenger transport. DST sleeper version has berths for fourteen passengers.

DC-3A. Same as DC-3 day plane but fitted with two Pratt & Whitney Twin-Wasp R-1830 engines.

DC-3B. Same as DC-3/DST convertible day plane or sleeper with two Pratt & Whitney Twin-Wasp engines.

DC-3C. Commercial "Executive" conversion by Douglas of the C-47 with two Pratt & Whitney Twin-Wasp engines. Two standard interior furnishings, with chairs, settees convertible to berths, buffet, etc.

DC-3D. Converted C-117A transport (two Pratt & Whitney Twin-Wasp engines), started as a military personnel transport but converted on the production line after cut back or termination of military contracts and completed as civil transport.

Under present C.A.A. regulations for scheduled airline operation all models of the 21-passenger DC-3 must not exceed 25,200 lbs. (11,440 kg.) loaded weight for take-off, nor 24,400 lbs. (11,080 kg.) for landing.

For purely cargo operation the C.A.A. has granted permission for the gross weight to be increased to 26,900 lbs. (12,212 kg.). This approval was granted to the DC-3C and DC-3D, both of which were built originally to military contracts (Army maximum permissible loaded weight 31,000 lbs.=14,080 kg.), without modification. Approvals for the DC-3, DC-3A and DC-3B are granted subject to certain modifications being made to the landing-gear.

At the end of 1946 there were 458 DC-3s in service in the United States, representing more than two-thirds of the total airliners flown on domestic routes.

Type.—Twin-engined Commercial Transport.

Wings.—Low-wing cantilever monoplane. Rectangular centre-section and tapering outer sections with detachable wing-tips. Douglas cellular multi-web construction. Wing area 987 sq. ft. (91.7 sq. m.). Fabric-covered ailerons, with controllable trim-tabs in the starboard aileron. Area of ailerons (two) 102.8 sq. ft. (9.55 sq. m.). Hydraulically-operated all-metal split trailing-edge flaps.

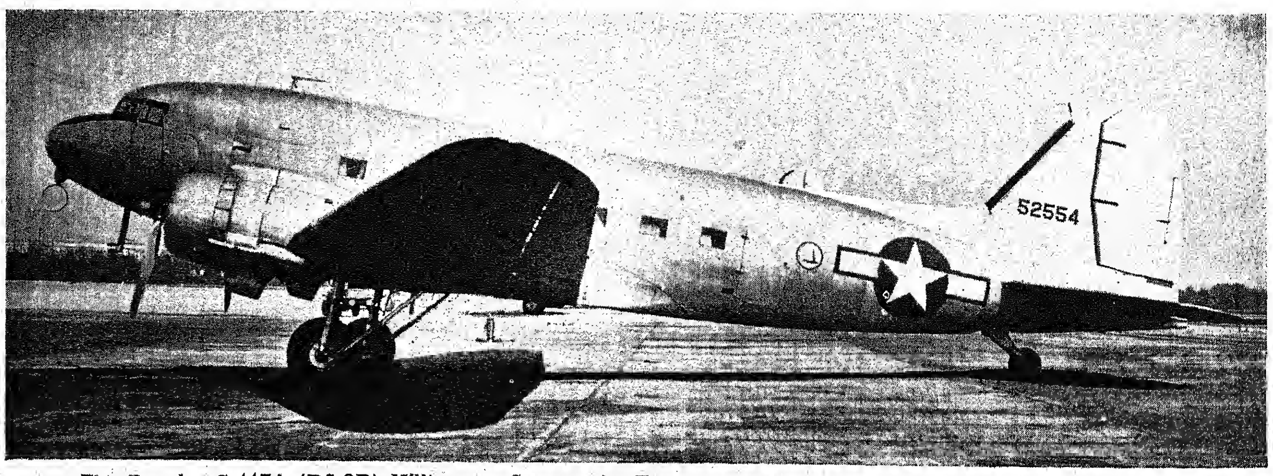
Fuselage.—Almost circular-section structure built up of transverse frames of formed sheet longitudinal members of extruded bulb angles, with a covering of smooth sheet.

Tail Unit.—Cantilever monoplane type. Tail-plane and fin of multi-cellular construction. Rudder and elevators have aluminium-alloy frames and fabric covering and are aerodynamically and statically balanced. Trim-tabs in all control surfaces. Areas: Fin 37.9 sq. ft. (3.52 sq. m.), Rudder (including balance) 46.6 sq. ft. (4.34 sq. m.), Tailplane 95.8 sq. ft. (8.9 sq. m.), Elevators 83.4 sq. ft. (7.75 sq. m.).

Landing Gear.—Retractable type. Each unit comprises two Bendix air-oil shock-absorber legs. Wheels are retracted forward and upward into engine nacelles and can be raised or lowered in 15 secs. by engine-driven hydraulic system. Bendix wheels and hydraulic wheel-brakes. Wheel track 18 ft. 6 in. (5.64 m.). Non-retractable Bendix steerable tail-wheel.

Power Plant.—Two 1,100 h.p. Wright Cyclone GR-1820-G102A or 1,200 h.p. GR-1820-G202A nine-cylinder, or 1,200 h.p. Pratt & Whitney Twin-Wasp R-1830-S1C3G fourteen-cylinder radial air-cooled engines with two-speed superchargers. Three-bladed Hamilton-Standard constant-speed airscrews. Two main fuel tanks (210 U.S. gallons = 794 litres) located forward of centre-section spar. Two auxiliary tanks (201 U.S. gallons = 760 litres) aft of spar. One oil tank (29¼ U.S. gallons = 109 litres) in each engine nacelle.

Accommodation.—The pilot's compartment is forward of the wing and is reached through a corridor from the passenger cabin. Emergency exit is provided in the ceiling of the pilot's compartment. Dual controls. The normal cabin accommodates up to twenty-one passengers. A sleeper (DST) version with separate compartments which can be made up with upper and lower bunks can accommodate fourteen passengers for night travel. The DST version used as a day plane with two passengers per seat can accommodate twenty-eight passengers. The cabin is completely sound-insulated and ventilation and steam heating systems are provided. There are four mail cargo compartments forward of the main cabin, two on each side of the centre aisle. The right forward compartment has a capacity of 35 cub. ft. (.991 cub. m.), and the compartment directly aft has a capacity of 50 cub. ft. (1.42 cub. m.). The left forward compartment has a capacity of 13.5 cub. ft. (.38 cub. m.), and is connected to a 50 cub. ft. (1.42 cub. m.) compartment directly aft. With these two compartments connected, it is possible to accommodate extra large parcels. An outside cargo loading door is located on



The Douglas C-117A (DC-3D) Military or Commercial Transport (two 1,200 h.p. Pratt & Whitney Twin-Wasp engines).—(*Peter Bowers*).

DOUGLAS—*continued.*

the left side aft of the pilot's seat. A baggage compartment of 103 cub. ft. (2.9 cub. m.) capacity is provided aft of the buffet and lavatory and has an outside loading door on the left side.

DIMENSIONS.—Span 95 ft. (28.9 m.), Length 64 ft. 5½ in. (19.63 m.), Height 16 ft. 11½ in. (5.2 m.).

WEIGHTS AND LOADINGS (Wright Cyclone GR-1820-G102A engines).—Weight empty 16,480 lbs. (7,482 kg.), Disposable load 8,720 lbs. (3,960 kg.), Weight loaded 25,200 lbs. (11,411 kg.), Maximum permissible landing weight 24,400 lbs. (11,080 kg.), Wing loading 25.5 lbs./sq. ft. (124.4 kg./sq. m.), Power loading 11.45 lbs./h.p. (5.2 kg./h.p.).

WEIGHTS AND LOADINGS (Wright Cyclone GR-1820-G202A engines).—Weight empty 16,600 lbs. (7,536 kg.), Disposable load 8,600 lbs. (3,905 kg.), Weight loaded 25,200 lbs. (11,441 kg.), Maximum permissible landing weight 24,400 lbs. (11,080 kg.), Wing loading 25.5 lbs./sq. ft. (124.4 kg./sq. m.), Power loading 10.5 lbs./h.p. (4.76 kg./h.p.).

WEIGHTS AND LOADINGS (Pratt & Whitney Twin-Wasp R-1830-S1C3G engines).—Weight empty 16,865 lbs. (7,657 kg.), Disposable load 8,335 lbs. (3,784 kg.), Weight loaded 25,200 lbs. (11,441 kg.), Maximum permissible landing weight 24,400 lbs. (11,080 kg.), Wing loading 25.5 lbs./sq. ft. (124.4 kg./sq. m.), Power loading 10.5 lbs./h.p. (4.76 kg./h.p.).

PERFORMANCE (Wright Cyclone GR-1820-G102A engines).—Maximum speed 216 m.p.h. (346 km.h.) at 7,700 ft. (2,350 m.), Cruising speed (maximum cruise power) 191 m.p.h. (306 km.h.), Initial rate of climb 1,080 ft./min. (329.4 m./min.), Service ceiling 21,700 ft. (6,620 m.), Normal range (maximum fuel and most economical speed) 1,510 miles (2,420 km.).

PERFORMANCE (Wright Cyclone GR-1820-G202A engines).—Maximum speed 220 m.p.h. (352 km.h.) at 7,900 ft. (2,410 m.), Cruising speed (maximum cruising power) 194 m.p.h. (310.4 km.h.) at 11,200 ft. (3,415 m.), Stalling speed 67 m.p.h. (107.8 km.h.), Initial rate of climb 1,070 ft./min. (326.3 m./min.), Service ceiling 21,900 ft. (6,680 m.), Normal range (maximum fuel and most economical speed) 1,510 miles (2,420 km.).

PERFORMANCE (Pratt & Whitney Twin-Wasp R-1830-S1C3G engines).—Maximum speed 230 m.p.h. (368 km.h.) at 8,500 ft. (2,590 m.), Cruising speed 207 m.p.h. (331.2 km.h.), Stalling speed 67 m.p.h. (107.8 km.h.), Initial rate of climb 1,130 ft./min. (345 m./min.), Service ceiling 23,200 ft. (7,076 m.), Normal range (maximum fuel and most economical cruising speed) 1,510 miles (2,420 km.).

The following were the last two production versions of the military DC-3.

C-117A. Two 1,200 h.p. Pratt & Whitney R-1830-90C engines. Combines the original features of the standard 21-seat commercial DC-3 with the latest improvements developed for the C-47 Series, including C-47 wing flaps and landing gear, hot-air cabin heating system and many internal changes. Small passenger door on left side, baggage compartment door forward of tail surfaces.

C-117B. Same as C-117A except fitted with Pratt & Whitney R-1830-90D engines.

The C-117 was produced for the A.A.F. at the Oklahoma City plant but production was cancelled after the surrender of Japan. Many were released for sale to the airlines or converted before completion by Douglas for sale as DC-3D.

THE DOUGLAS SKYTRAIN.

U.S. Army Air Forces designation: C-47.
U.S. Navy designation : R4D.
British name : Dakota.

The C-47 Skytrain was the most commonly-used transport in the Allied Air Forces and operated in every theatre of war. It existed in the following forms :—

C-47 (R4D-1 and Dakota I). Two Pratt & Whitney R-1830-92 engines. All-purpose transport. Large cargo loading doors, reinforced metal floor and tie-down fittings, wood seats folding against sides of cabin, etc. Glider-towing cleat, formerly exclusive to the C-53, is now a standard fitting on the C-47.

C-47A (R4D-5 and Dakota III). Same as C-47 except fitted with a 24-volt instead of a 12-volt electrical system. Description that follows refers to the C-47A.

C-47B (R4D-6 and Dakota IV). Same as C-47A except fitted with two Pratt & Whitney R-1830-90C engines with two-stage blowers and provision for carrying increased fuel in the cabin.

TC-47B (R4D-7). Navigational trainer version of the C-47B.

XC-47C. C-47 fitted experimentally with an Edo twin-float amphibian installation.

TYPE.—Twin-engined Military Transport.

WINGS, FUSELAGE, TAIL UNIT AND LANDING GEAR.—Same as DC-3.

POWER PLANT.—Two Pratt & Whitney R-1830-92 Twin-Wasp fourteen-cylinder radial air-cooled geared and supercharged engines each rated at 1,050 h.p. at 7,500 ft. (2,205 m.) and with 1,200 h.p. available for take-off. Hamilton-Standard three-blade constant-speed airscrews. Two main fuel tanks (202 U.S. gallons=764 litres each) located forward of centre-section spar. Two auxiliary tanks (200 U.S. gallons=757 litres each) aft of spar. Each engine is served by a separate fuel system but cross-feed permits both engines to be supplied by either set of tanks in case of emergency. Oil dilution system. One oil tank (29 U.S. gallons=109 litres) in each engine nacelle.

ACCOMMODATION.—Crew of three consisting of pilot, co-pilot and radio operator. Fuselage divided into six compartments—pilot's compartment; port and starboard baggage compartment; radio operator's compartment; main cargo hold and lavatory. Pilot's compartment seats two side-by-side with dual controls. Automatic pilot. Full radio equipment includes radio compass, marker beacon receiver and receivers for localised and glide-path reception for the instrument-landing equipment. Steam or hot air heating and ventilation. Main cargo hold equipped with snatch block, idler pulley and tie-down fittings for cargo handling. Large freight door on port side. Cargo load of 6,000 lbs. (2,722 kg.) may include three aero-engines on transport cradles, or two light trucks. Folding seats down sides of cabin for 28 fully-armed airborne or parachute troops. Alternatively fittings for eighteen stretchers together with provision for medical crew of three. Racks and release mechanism for six parachute pack containers under fuselage. Also under the fuselage are fittings for carrying two three-bladed airscrews. Glider-towing cleat in tail. De-icing equipment includes airscrew anti-icing system, rubber de-icer shoes on outer wings, tailplane and fin leading-edges and alcohol-type windscreen de-icer. Oxygen equipment.

DIMENSIONS.—Span 95 ft. (28.9 m.), Length 64 ft. 5½ in. (19.63 m.), Height 16 ft. 11½ in. (5.2 m.).

WEIGHTS AND LOADINGS.—Weight empty 16,970 lbs. (7,705 kg.), Useful load 8,600 lbs. (3,904 kg.), Weight loaded 26,000 lbs. (11,805 kg.), Maximum permissible loaded weight 31,000 lbs. (14,080 kg.), Wing loading 25.3 lbs./sq. ft. (123.5 kg./sq. m.), Power loading 12 lbs./h.p. (5.45 kg./h.p.).

PERFORMANCE.—Maximum speed 229 m.p.h. (368 km.h.) at 8,500 ft. (2,590 m.), Cruising speed 185 m.p.h. (296 km.h.) at 10,000 ft. (3,050 m.), Stalling speed 67 m.p.h. (107.8 km.h.), Initial rate of climb 1,170 ft./min. (356 m./min.), Service ceiling 24,100 ft. (7,350 m.), Normal range 1,500 miles (2,400 km.).

THE DOUGLAS SKYTROOPER.

U.S. Army Air Forces designation: C-53.
U.S. Navy designation : R4D.
British name : Dakota II.

The Douglas C-53 Skytrooper was similar to the C-47 but it had not the facilities for carrying heavy cargo. Power-plant, dimensions and other general particulars are the same as for the C-47. The following were the principal versions :—

C-53 (R4D-3). Pratt & Whitney R-1830-92 engines. Cargo-carrier, paratroop and troop transport and glider-tug. Normal wooden floor. No large loading door. Fixed metal seats for twenty-eight fully-armed airborne or parachute troops. Glider towing-cleat in tail.

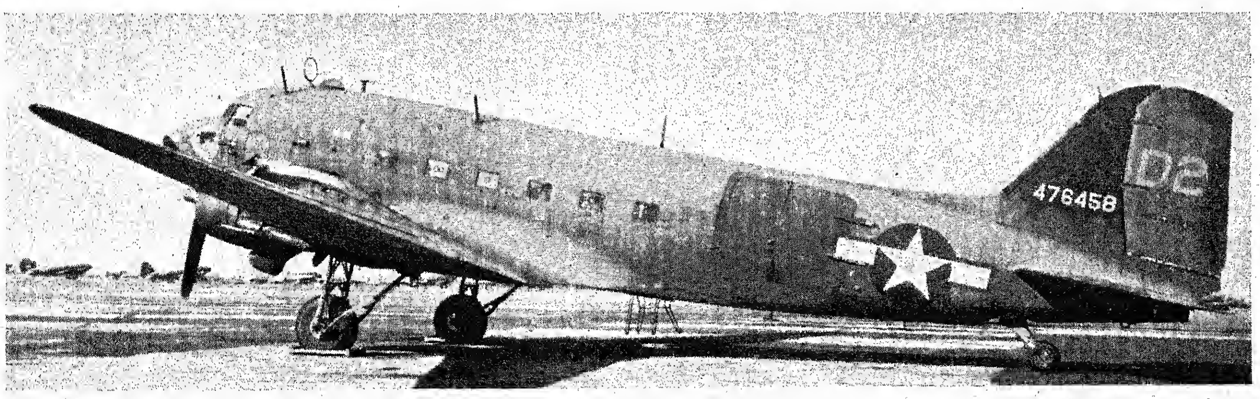
XC-53A. Experimental C-53 with full-span flaps and hot-air wing and tail de-icing. Only one.

C-53B. Pratt & Whitney R-1830-82 engines. First "winterised" C-53. Extra tankage.

C-53C (R4D-4). Pratt & Whitney R-1830-92 engines. C-53 with minor interior changes. Troop Carrier.

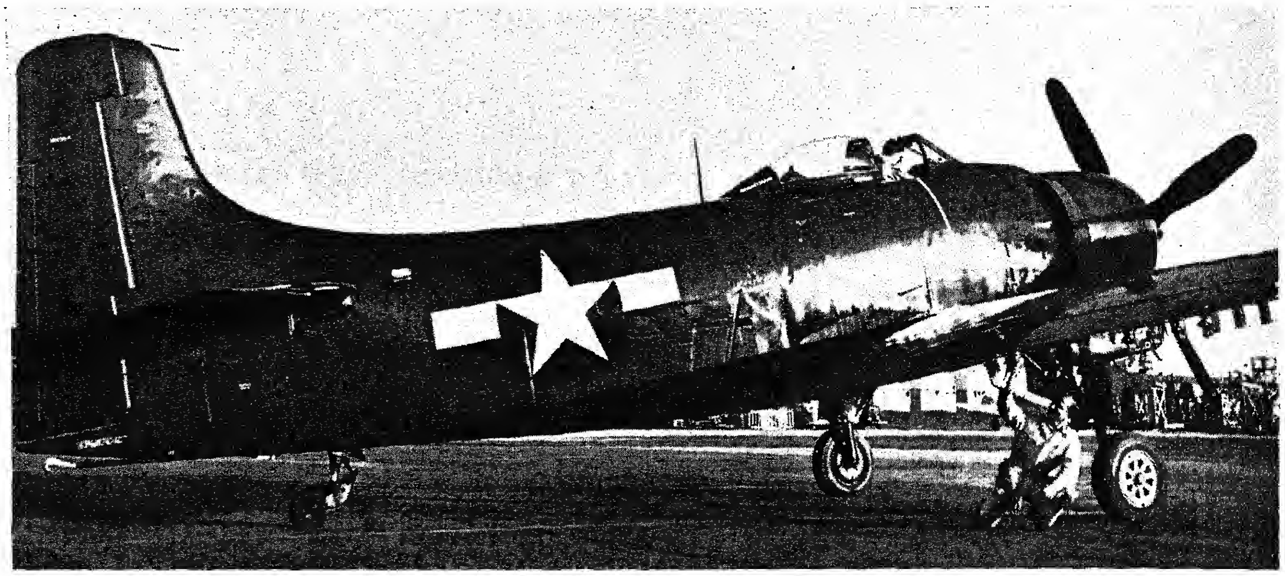
C-53D. Pratt & Whitney R-1830-92 engines. First C-53 with 24-volt electrical system. Troop Carrier.

Since VJ-Day and up to the end of 1946, the U.S. Government had sold nearly 4,000 surplus C-47, C-53 and C-117 military transports to companies and individuals in the United States and overseas for commercial use, and hundreds had been disposed of for scrap and spare parts.



A Standardised version of the Douglas Skytrain which carries both U.S. Army C-47B and U.S. Navy R4D-6 designations.—(*Peter Bowers*).

***DOUGLAS**—continued.*



The Prototype Douglas XBT2D-1 Single-seat Naval Attack Monoplane (2,400 h.p. Wright R-3350-24 engine).

THE DOUGLAS SKYRAIDER.

U.S. Navy designation : AD-1 (formerly XBT2D-1).

The Skyraider was the third design conceived by the Douglas company to replace the SBD dive-bomber. Under the original designation XBT2D-1, the design was submitted to the U.S. Navy in July, 1944, and the prototype first flew in the following April. It is now in production under the new simplified Naval Attack designation AD-1.

TYPE.—Single-seat Naval Attack monoplane.

WINGS.—Low-wing cantilever monoplane. All-metal structure in three-main sections, comprising a centre-section and two upward-folding outer sections. Hydraulic folding controlled from cockpit. Gross wing area 400.33 sq. ft. (37.19 sq. m.). All-metal ailerons on outer sections with trim and balance tabs in each. Hydraulically operated Fowler-type trailing-edge landing flaps on centre-section.

FUSELAGE.—All-metal monocoque structure with integral fin. The dive-brakes are components of the fuselage and consist of three rectangular surfaces, one on each lower side of the fuselage and one below, hinged at their forward ends in line with the trailing-edge of the wings. These surfaces are extended hydraulically outwards and downwards into the airstream.

TAIL UNIT.—Cantilever monoplane type. All-metal structure including covering of movable surfaces. Electrically-controlled adjustable tailplane. Aerodynamically and statically balanced rudder and elevators. Trim and balance tabs in rudder.

LANDING GEAR.—Retractable two-wheel type. Main wheels on single compression legs are raised backwards and turn through 90 degrees while retracting to lie flat within wing. Hydraulic actuation. Forwardly-retracting tail-wheel. Deck arrester hook aft of tail wheel.

POWER PLANT.—One Wright R-3350-24 eighteen-cylinder two-row radial air-cooled engine rated at 2,100 h.p. and with 2,400 h.p. available for take-off. Engine mounted at $4\frac{1}{2}°$ downthrust. Aeroproducts four-blade constant-speed airscrew 13 ft. 6 in. (4.11 m.) diameter. Single leakproof fuel cell occupies the entire fuselage bay aft of the pilot's cockpit. Long-range fuel tanks may be carried on the wing bomb shackles.

ACCOMMODATION.—Pilot's cockpit with blister-type blown canopy over fore part of wing with downward vision angle of 15 degrees. Full naval radio and radar equipment.

ARMAMENT.—Two 20 m/m. cannon, one in each extremity of the centre-section inboard of the wing-fold hinges. Launchers for twelve 5 in. (12.7 c/m.) zero-length and two 12 in. (30.5 c/m.) "Tiny Tim" rocket projectiles under wings. Torpedo carried externally in crutches under the fuselage. Bomb racks under the fuselage and each outer wing. Bomb load (normal) 4,000 lbs. (1,816 kg.), (maximum) 6,000 lbs. (2,722 kg.).

DIMENSIONS.—Span 50 ft. $0\frac{3}{16}$ in. (15.24 m.), Width folded 24 ft. (7.32 m.), Length 39 ft. $3\frac{3}{4}$ in. (12 m.), Height (over airscrew) 15 ft. 10 in. (4.82 m.).

WEIGHT EMPTY.—10,470 lbs. (4,749 kg.).

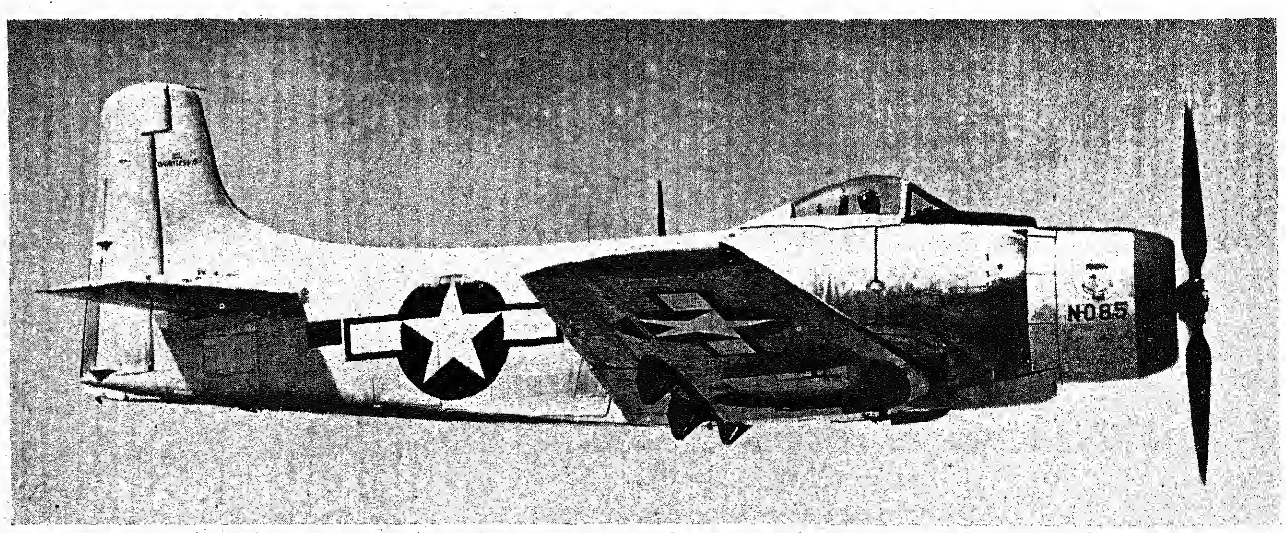
PERFORMANCE.—No data available, except service ceiling, over 25,000 ft. (7,620 m.), Range over 1,500 miles (2,412 km.).

THE DOUGLAS DESTROYER.

U.S. Navy designation : XBTD-1.

The XBTD-1 was a single-seat Bomber/Torpedo-carrier conversion of the SB2D-1. The rear cockpit and remotely-controlled turrets were removed and the bomb-bay was modified to accommodate either a maximum of two 1,600 lb. (726.4 kg.) bombs or one standard naval air torpedo. The armament was reduced to the two fixed forward-firing 20 m/m. wing cannon. The wings, tail-unit and tricycle landing-gear were basically the same as for the SB2D-1. The power-plant consisted of one Wright R-3350-14 two-row radial air-cooled engine driving a Hamilton Standard Hydromatic constant-speed airscrew.

A new type of dive-brake was incorporated in the XBTD-1. This consisted of a series of surfaces hinged at their forward ends to the fuselage below the trailing-edge of the wings. When lowered these surfaces resembled six fingers extended in fan-wise fashion. With these brakes practically no adverse effect was found on control in a dive. Wing lift was entirely unaffected and trim change was found to be negligible. This



The Prototype Douglas XBT2D-1 Single-seat Naval Attack Monoplane which is now in production as the AD-1.

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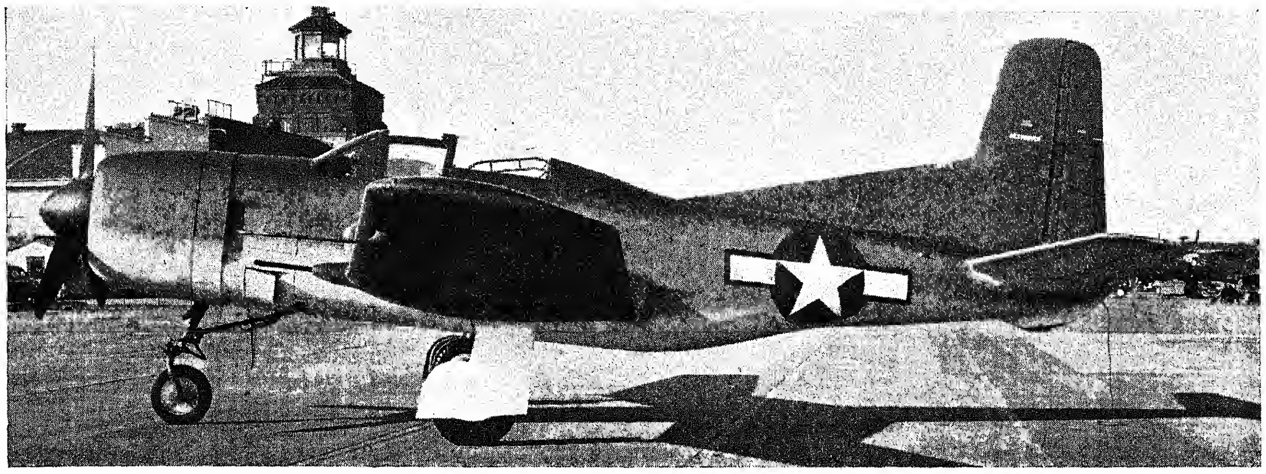


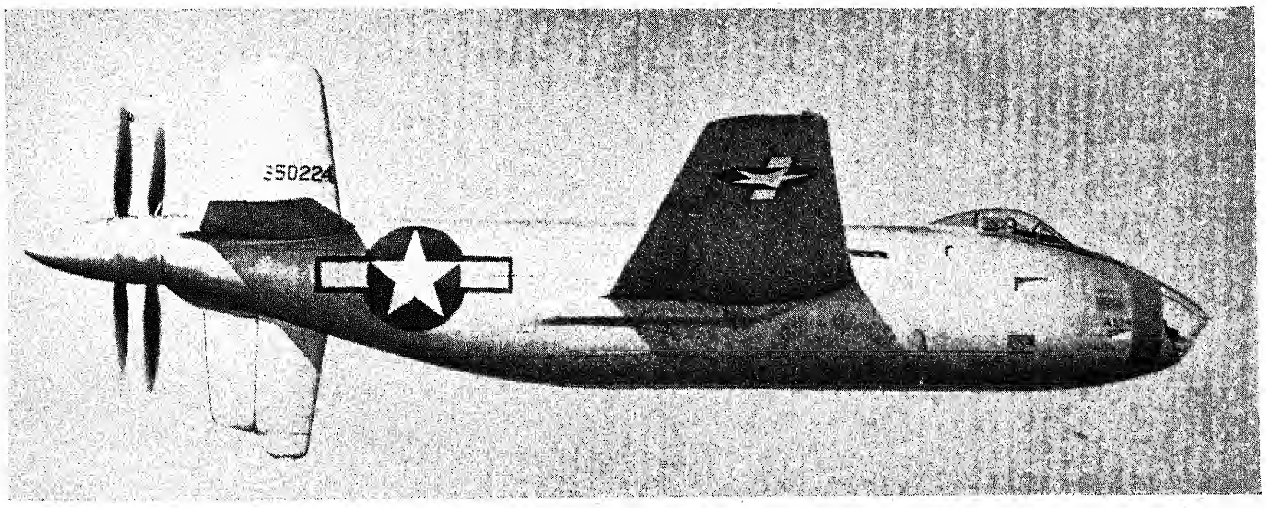
The Douglas XBTD-1 Destroyer Single-seat Bomber-Torpedo Monoplane (Wright R3350-14 engine).

type of brake is incorporated in a modified form in the Douglas AD-1, which is now a standard Naval attack aircraft.

DIMENSIONS.—Span 48 ft. (14.64 m.), Length 38 ft. 7 in. (11.77 m.), Height (over airscrew, one blade vertical) 16 ft. 2 in. (4.93 m.).

WEIGHT LOADED.—18,000-19,000 lbs. (8,170-8,630 kg.).

PERFORMANCE.—Maximum speed 345 m.p.h. (552 km.h.), Cruising speed 230-250 m.p.h. (368-400 km.h.), Rate of climb 1,600 ft./min. (488 m./min.), Service ceiling 24,000 ft. (7,320 m.), Range 2,140 miles (3,425 km.).



The Douglas XB-42 Medium Attack-Bomber (two 1,725 h.p. Allison V-1710-125 engines mounted in the fuselage).

THE DOUGLAS XB-42.

The XB-42 is an experimental mid-wing monoplane developed by the Douglas Company to Air Technical Service Command contract and powered by two Allison liquid-cooled engines mounted in the fuselage and driving contra-rotating pusher propellers behind the rudder through extension shafts. The XB-42 flew for the first time in June, 1944, and on December 8 of that year it made a fast flight from Long Beach, California, to Washington, D.C., a distance of 2,290 miles (3,665 km.), at an average speed of 432 m.p.h. (695 km.h.). Subsequently the prototype XB-42 was crashed at Washington on December 15, 1945, through no fault of either airframe or power-plant installation. A second prototype differs from the original model by having a single cockpit enclosure in place of the twin blister canopies.

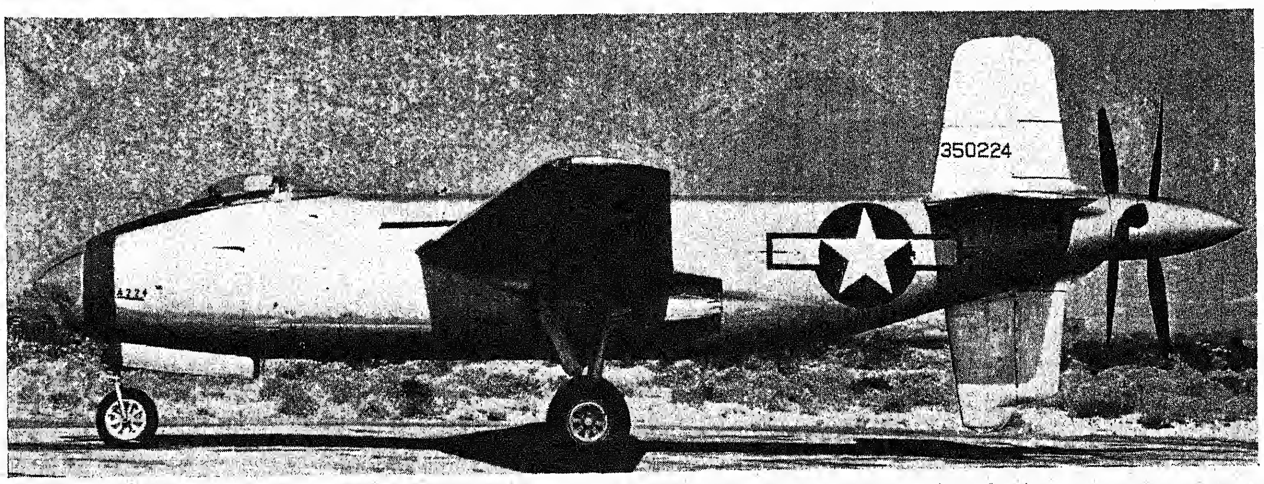
TYPE.—Twin-engined Medium Attack bomber.

WINGS.—All-metal cantilever mid-wing monoplane. Laminar flow aerofoil section. All-metal ailerons and slotted trailing-edge flaps.

FUSELAGE.—All-metal monocoque structure.

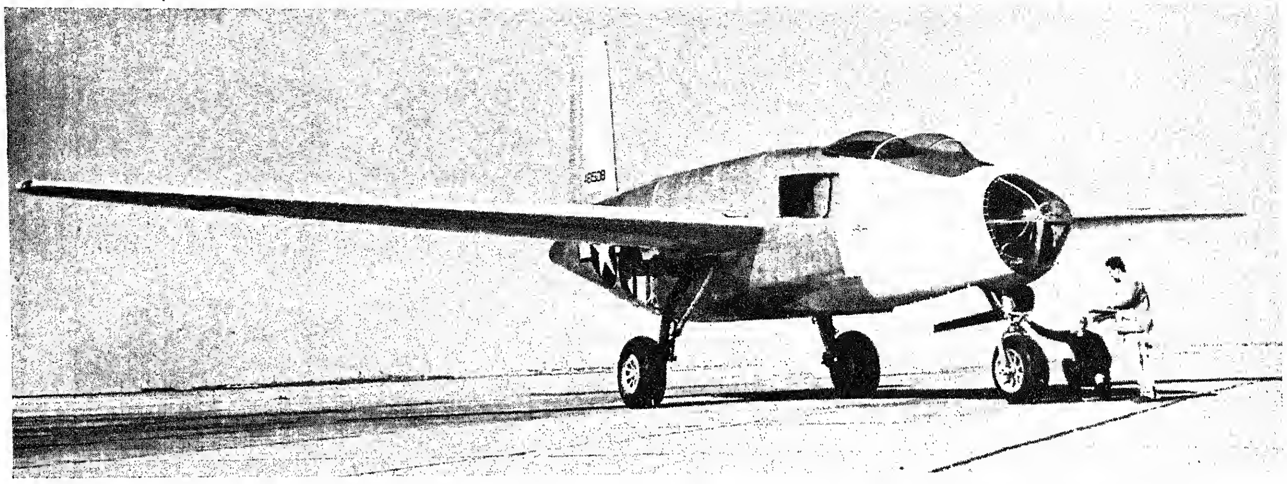
TAIL UNIT.—All-metal cantilever structure. Twin fins and rudders, one above and one below fuselage.

LANDING GEAR.—Tricycle type. Main and nose wheels retract upward and backward into fuselage. Emergency bumper skid in bottom of lower fin.



The Douglas XB-42 Medium Attack-Bomber (two Allison V-1710-125 engines).

DOUGLAS—*continued.*



The Douglas XB-43, a jet-propelled version of the XB-42. The two General Electric TG-180 gas-turbines exhaust aft of the tail-unit.

Power Plant.—Two Allison V-1710-125 twelve-cylinder Vee liquid-cooled engines, each rated at 1,725 h.p. for take-off with water injection, mounted side-by-side in the fuselage aft of the pilot's cockpit and driving two Curtiss Electric three-blade co-axial contra-rotating propellers behind tail-unit by shaft drive. Propellers are independently driven and independently feathering. Engines are connected to propeller reduction gear by steel drive shafts in 5 ft. (1.52 m.) lengths carried at each joint on ball-bearing supports to provide for air load deflections in fuselage.

Accommodation.—Crew of three. Pilot's compartment ahead of the wing seats two side-by-side with separate blister canopies for pilot and co-pilot/navigator. Glazed nose for bombardier on Bomber version is replaceable by solid nose mounting various armaments for Attack version.

Armament.—Four .5-in. (12.7 m/m.) remotely-controlled and sighted flexibly-mounted guns in trailing-edge of wings inboard of ailerons and firing aft. Attack version has nose-section containing combination of guns ranging from eight .5-in. (12.7 m/m.) guns to one 75 m/m. cannon and two .5-in. (12.7 m/m.) guns. Maximum bomb load 8,000 lbs. (3,629 kg.) carried internally.

Dimensions.—Span 70 ft. 0 in. (21.34 m.), Length 53 ft. 0 in. (16.15 m.).

Weights and Loadings.—Weight empty 19,149 lbs. (8,687 kg.), Weight loaded 35,702 lbs. (16,194 kg.), Power loading (fully loaded) (take-off power) 5.46 lbs./h.p. (2.47 kg./h.p.).

Performance.—Maximum level speed 410 m.p.h. (660 km.h.), Range (approximate) 5,000 miles (8,046 km.).

THE DOUGLAS XB-43.

The XB-43 is similar in general arrangement and construction to the XB-42 except that it is fitted with two General Electric TG-180 gas turbine engines mounted in the same position as the Allison engines in the XB-42, the twin jet exhausts replacing the propellers in the tail. A noticeable external change is the location of all vertical fin and rudder area above the fuselage, the absence of propellers making it unnecessary to provide fin area below the fuselage to serve as a propeller guard.

The prototype XB-43 made its first test flight at the Muroc Experimental Test Base on May 17, 1946.

Dimensions.—Span 71 ft. 2 in. (21.7 m.), Length 51 ft. 6 in. (15.7 m).

Weights and Performance.—No data available.

THE DOUGLAS INVADER.

U.S. Army Air Forces designation : A-26.
U.S. Navy designation : JD-1.

The contract for the prototype XA-26 was placed in June, 1941. Actually three experimental models were produced to the basic design, the XA-26 light bombardment and attack aeroplane, the XA-26A, a modification for use as a night fighter, and the XA-26B attack-bomber, mounting a large calibre cannon.

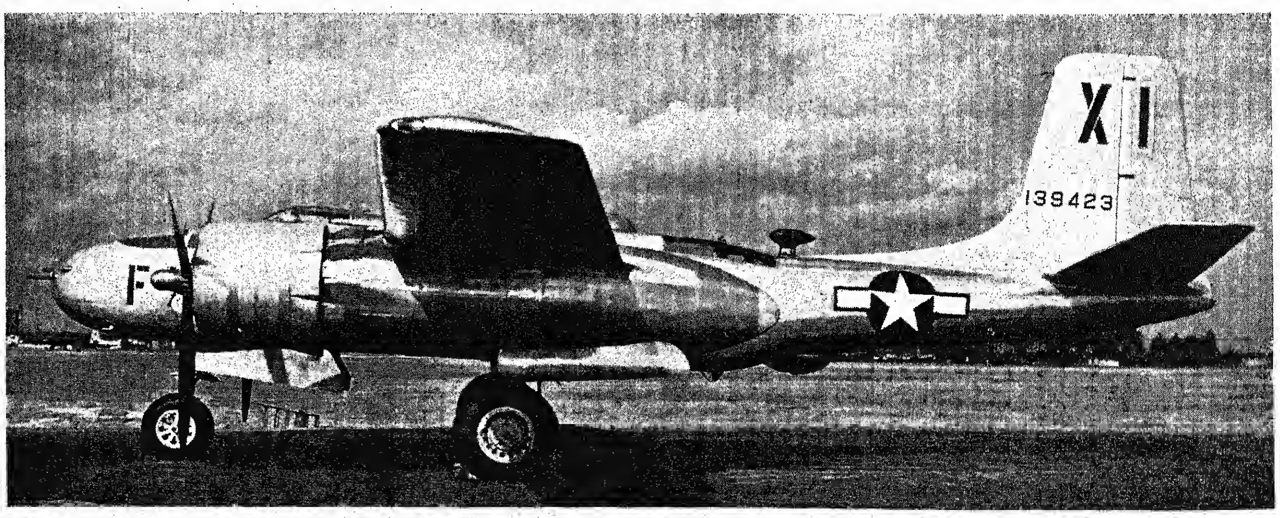
The XA-26 was flown for the first time on July 10, 1942, and it is interesting to note that this aeroplane carried approximately twice the bomb load required by the original specification and exceeded every performance guarantee. It was also 700 lbs. (318 kg.) under the designed weight. Tests with these three experimental models culminated in the design of the production A-26B which carried additional armour protection for the pilot and a closed-in nose armed with six .5 in. (12.7 m/m.) machine-guns. The A-26C which served as a lead ship, was fitted with a transparent bombardier nose and two forward-firing .5 in. (12.7 m/m.) guns. The FA-26C was the photographic-reconnaissance version.

The A-26D was to have been similar to the A-26B but with a revised armament consisting of eight 0.5 in (12.7 m/m.) guns in the solid nose and six 0.5 in. (12.7 m/m.) guns in the wings. All orders for this version were cancelled after VJ-Day.

The XA-26F is an experimental conversion of an A-26B fitted with an auxiliary General Electric I-16 (U.S. Army designation J-31) turbo-jet unit in the fuselage and exhausting aft of the tail-unit. The jet installation, which replaces the rear gunner and the defensive turret armament, was made during the war with the aim of adding 35 m.p.h. (56 km.h.) to the maximum speed of the Invader. The project, however, was not completed until two months after VJ-Day.

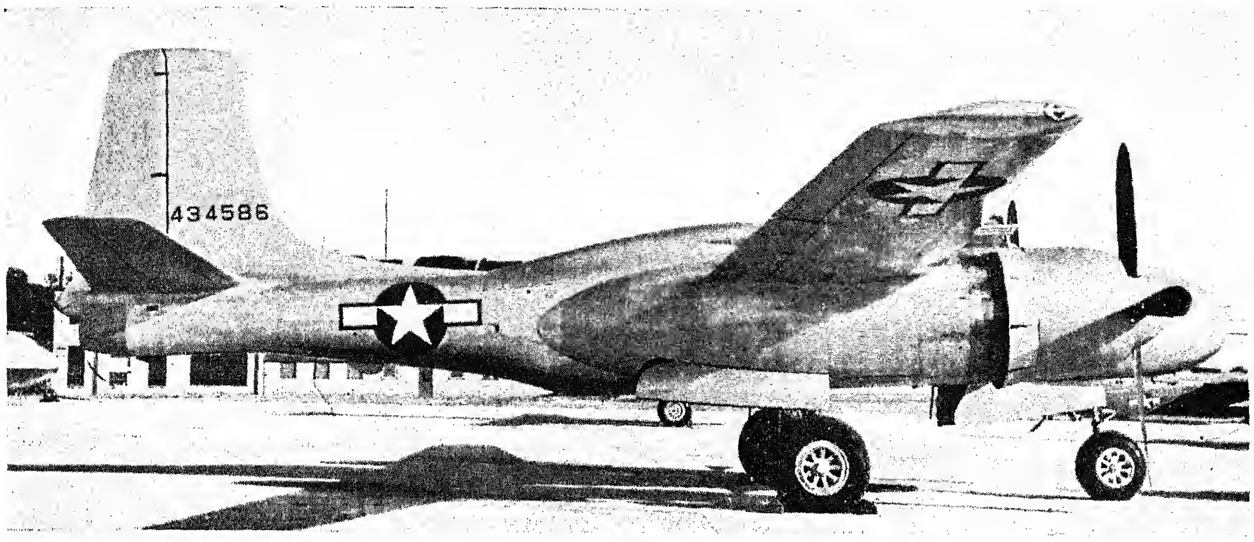
The air scoop for the jet unit is above the fuselage amidships and the exhaust is through a tube 17 in. (43 c/m.) in diameter and 19 ft. (5.8 m.) long from engine to tail. A standard 125 U.S. gallon (473 litre) fuel tank modified to carry kerosene was installed in the upper rear section of the bomb-bay, providing sufficient jet fuel for 25 minutes at full r.p.m.

On June 26, 1946, the XA-26F established a new speed record of 413 m.p.h. (661 km.h.) over 1,000 km. (621 miles) carrying 1,000 kg. (454 lbs.) of useful load. Water injection was not used for the two Pratt & Whitney R-2800-83 engines but the



The Douglas A-26B Invader Attack Bomber (two 2,000 h.p. Pratt & Whitney R.2800-71 engines).

DOUGLAS—*continued.*



The Douglas XA-26F Invader which was fitted with an auxiliary General Electric I-16 gas-turbine in place of the rear defensive armament amidships.—(*Peter Bowers*).

auxiliary jet engine was operated for 45 minutes of the flight, which was made at a height of 22,000 ft. (6,710 m.).

The JD-1 is a stripped version of the Invader used by the U.S. Navy as a target-tug.

The Invader first went into action in the European Theatre of Operations on November 19, 1944.

A total of 2,502 A-26 Invaders were built before production was stopped after VJ-Day. The Invader is still a standard service type in the U.S. Army Air Forces and it is also used to equip light bomber squadrons of the National Guard.

Type.—Twin-engined Attack Bomber.

Wings.—Shoulder-wing cantilever monoplane. NACA low-drag laminar-flow wing section. Incidence (root) 2°, (tip) 1°. Dihedral (on median line) 4.5°. Root chord (on centre-line) 10 ft. 8 in. (3.25 m.), projected tip chord 4 ft. 10 in. (1.47 m.). Complete left and right-hand wing panels attach directly to fuselage without centre-section. Two-spar structure, the spars being built up of unspliced spar caps having integral end fittings. Chordwise stiffeners and flush-riveted Alclad skin. Wing area (less ailerons) 513.3 sq. ft. (47.68 sq. m.). Electrically-operated slotted trailing-edge flaps. Area of flaps 55.9 sq. ft. (5.19 sq. m.).

Fuselage.—All-metal semi-monocoque structure. Channel section formers, extruded longitudinal stringers and a flush-riveted Alclad skin.

Tail Unit.—Cantilever monoplane type. All-metal structure with stressed-skin covering, except for fabric-covered rudder. Trimming-tabs in elevators and rudder. Tailplane dihedral 10° 35 min. Tailplane span 23 ft. 1 in. (7 m.). Area of fin 48.23 sq. ft. (4.48 sq. m.). Area of rudder 23.1 sq. ft. (2.14 sq. m.).

Landing Gear.—Retractable tricycle type. Main wheels on single telescopic legs retract backwards into engine nacelles. Nose wheel on single leg which retracts backwards, turning through 90° to lie flat in the fuselage. Hydraulic actuation. Track 19 ft. 5.6 in. (5.94 m.), Wheel base 13 ft. 4 in. (4 m.).

Power Plant.—Two Pratt & Whitney R-2800-71 eighteen-cylinder radial air-cooled engines with two-speed superchargers, each rated at 1,600 h.p. and with 2,000 h.p. available for take-off. Three-blade Hamilton Standard Hydromatic constant-speed quick-feathering airscrews 12 ft. 7 in. (3.84 m.) diameter. Engine mountings, interchangable right to left or *vice-versa*, built up of a large metal spinning forward and a stainless steel rear part, tied together by six identical forgings. The six engine attachment points pick up the front of the forgings and the bolts for removing the whole power-plant installation tie the aft end of the forgings and the engine mounting to the nacelle. All lines, pipes and wiring grouped together inside skin of mounting and fitted with quick release fittings. Cowling in two halves, upper and lower, and quickly removable. Quick-release access panels and doors in mounting. Access door in fire-wall permits mechanic to enter nacelle to work on engine accessory section. Two main fuel tanks (300 U.S. gallons = 1,136 litres each), one in each nacelle. Two wing tanks (100 U.S. gallons = 378 litres each) inboard of nacelles. Auxiliary tank (125 U.S. gallons = 473 litres) in top forward section of bomb-bay. Total normal fuel capacity 925 U.S. gallons (3,502 litres). Long-range ferrying-tank (675 U.S. gallons = 2,555 litres) may be carried in bomb-bay. One 30 U.S. gallon (2,555 litre) oil tank in top of each engine nacelle aft of leading-edge. Oil cooling intakes in leading-edge of wing outboard of nacelles.

Accommodation.—Normal crew of three. Pilot on port side of cockpit with bomb-aimer/radio-operator/gun-loader on starboard side and slightly to rear. Observer/turret-gunner in rear cockpit facing aft.

Armament.—Standard armament of A-26B consists of eighteen .5 in. (12.7 m/m.) machine-guns, six in nose (four on starboard side and two on port side); four under each wing outboard of airscrew discs in twin "package" mountings; two in dorsal turret remotely-controlled by the observer with periscopic sighting; and two in under-turret similarly controlled by the observer. Upper turret can be fixed to fire forward and operated by pilot. Guns in lower turret trained to fire slightly below horizontal and can be depressed downwards 90°. 2,400 maximum rounds for six nose guns, 1,000 rounds for each pair of turret guns. Alternative interchangeable nose armaments may consist of two 37 m./m guns; one 37 m/m. with two .5 in. (12.7 m/m.) guns on port side; one 37 m/m. with four starboard .5 in. (12.7 m/m.) guns; one 75 m/m. cannon with two port .5 in. (12.7 m/m.) guns; and one 75 m/m. cannon with one 37 m/m. gun on port side. A-26C has transparent bomb-aimer's nose with only two .5 in. (12.7 m/m.) guns in troughs on starboard side. Later A-26C has three .5 in. (12.7 m/m.) guns in each wing in place of "package" guns. Bomb-bay may accommodate a maximum of four 1,000 lb. (454 kg.) bombs. A maximum of four 500 lb. (454 kg.) bombs may be carried under wings when bomb-bay load reduced to six 500 lb. (227 kg.) bombs. Other alternative bomb-loads up to a maximum of 5,000 lbs. (2,270 kg.). Two 2,000 lb. (907 kg.) torpedoes may be carried in bomb-bay.

Armour.—Heavy dural armour plating along sides of fuselage from nose to rear of observer's cockpit; under nose and both cockpits; in front and behind crew positions; under engine and in tail. Bullet-proof glass in cockpit canopy.

Dimensions.—Span 70 ft. (21.35 m.), Length (A-26B) 50 ft. 9 in. (15.47 m.), Length (A-26C) 51 ft. 3 in. (15.63 m.), Height (over fin and rudder) 18 ft. 6 in. (5.64 m.).

Weights.—Normal loaded weight 27,000 lbs. (12,260 kg.), Maximum permissible loaded weight 32,000 lbs. (14,530 kg.).

Performance.—Maximum speed (normal rated power) 359 m.p.h. (574.4 km.h.) at 16,700 ft. (5,090 m.), Cruising speed (62.5% power) 266 m.p.h. (4,256 km.h.) at 5,000 ft. (1,525 m.), Operational range at cruising speed with designed useful load 700 miles (1,120 km.), Maximum range (without ferry tank) 1,600 miles (2,560 km.) at 5,000 ft. (1,525 m.) at 206 m.p.h. (329.6 km.h.), Maximum range (with ferry tank) 3,000 miles (4,800 km.) at 5,000 ft. (1,525 m.) at 210 m.p.h. (336 km.h.), Service ceiling 28,500 ft. (8,690 m.), Ceiling on one engine 14,400 ft. (4,390 m.).

EDO.

THE EDO AIRCRAFT CORPORATION.

Head Office and Works: College Point, Long Island, New York.

President: Earl D. Osborn.

Vice-President in charge of Engineering: Boris Korvin-Kroukovsky.

Vice-President in charge of Production: Kenneth D. Vosler.

Vice-President in charge of Sales: George B. Post.

Sales Manager: Paul Battilana.

Sales Promotion and Advertising Manager: Frank Sunderland.

Manager of Commercial Float Sales: Major Robert Fogg.

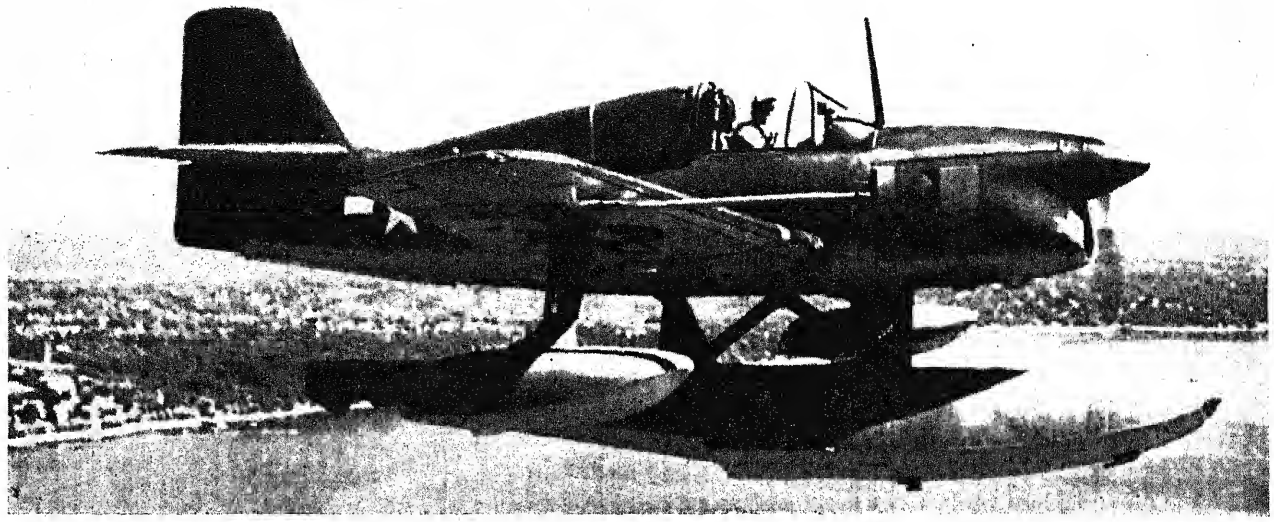
Assistant Sales Manager: F. Farny Eilers.

The Edo Aircraft Corporation was formed on October 29, 1925, by Mr. Earl D. Osborn, who was formerly connected with Aeromarine Airways.

The Corporation has specialised in the production of all-metal seaplane floats, and has produced them in large numbers. Edo floats have been installed on both civil and military aircraft of over 300 different types, the first Edo floats being fitted to a Waco 9. Orders have been executed for the governments of Jugoslavia, Norway, Sweden, Colombia and Italy, and 19 different types of U.S. Army and Navy aircraft were equipped with Edo floats during the War.

The Edo Corporation has also developed seaplane beaching trolleys and amphibious gear and, during the war, was also engaged in manufacturing sub-assemblies for the Grumman F6F Hellcat.

EDO—*continued.*



The Edo XOSE-1 Single-seat Scout-Observation Seaplane (550 h.p. Ranger V-770-8 engine).

The first Edo-designed aircraft is a single-seat Observation Scout monoplane designated the XOSE-1, a specification and illustrations of which follow.

THE EDO XOSE-1.

The XOSE-1 is a single-seat Scout-Observation Catapult seaplane while the XTE-1 is a two-seat trainer version.

TYPE.—Single or two-seat Observation Scout.

WINGS.—All-metal cantilever low-wing monoplane. Aerofoil section NACA 2417 at roots tapering to NACA 2409 at tips. Two-spar structure built in three sections consisting of centre-section and two outer wings. Mean aerodynamic chord 6 ft. 5.9 in. (1.98 m.). Outer sections fold upwards and backwards about rear spar and lie alongside fuselage with leading-edges downward. Leading-edge slots in outer sections. All-metal ailerons and slotted flaps in two sections between ailerons and fuselage. Trim-tab in port aileron. Wing area 237 sq. ft. (22 sq. m.).

FUSELAGE.—All-metal monocoque structure of oval section.

TAIL UNIT.—All-metal cantilever monoplane type. Horn-balanced rudder and elevators. Trim-tabs in port elevator and in rudder. Tailplane span 14 ft. 0 in. (4.27 m.).

FLOATS.—Central single-step float attached to fuselage by two main struts with diagonal members between. Beam 4 ft. (1.22 m.), Displacement 8,600 lbs. (3,901 kg.). Single-step wing-floats attached by single-struts to outer wing sections at right-angles to undersurface of spar. Beam 1 ft. 10$\frac{5}{8}$ in. (0.57 m.), Displacement 725 lbs. (329 kg.) each. Wheel undercarriage optional for ferrying purposes.

POWER PLANT.—One 550 h.p. Ranger V-770-8 twelve-cylinder inverted vee air-cooled engine in quickly detachable self-contained power unit attached to the fireproof bulkhead by four bolts. Hamilton Standard D6101A-12 two-blade constant-speed airscrew, 9 ft. 0 in. (2.74 m.) diameter.

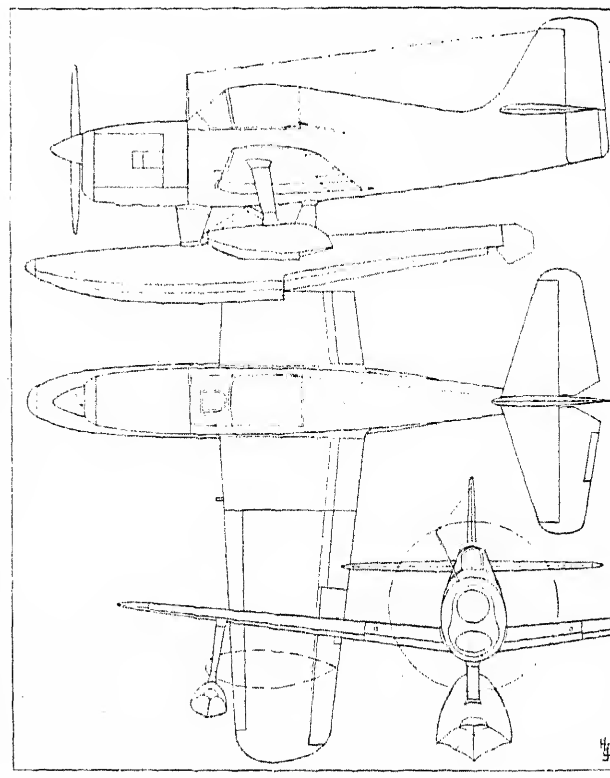
ACCOMMODATION.—Pilot's cockpit with one-piece cover which slides backwards and downwards for access. Bullet-proof windscreen and pilot armour.

ARMAMENT.—Two forward-firing machine-guns mounted one in each centre-section outside airscrew disc. Bomb-racks under centre-section.

EQUIPMENT.—Rescue cells (capacity each one person) may be attached to bomb-racks. Radar and smoke-screen ejectors.

DIMENSIONS.—Span 37 ft. 11$\frac{9}{16}$ in. (11.57 m.), Width folded 14 ft. 6 in. (4.42 m.), Length (tail up) 31 ft. 0$\frac{3}{4}$ in. (9.45 m.), Height (tail up) 14 ft. 11 in. (4.55 m.), Height (on beaching trolley, over rudder) 13 ft. 3 in. (4 m.), Height folded 13 ft. 8 in. (4.16 m.).

WEIGHTS AND LOADINGS.—No data available.



The Edo XOSE-1 Seaplane.

PERFORMANCE.—Maximum speed, over 200 m.p.h. (322 km.h.), Initial rate of climb 1,500 ft./min. (457 m./min.). Range, over 1,000 miles (1,609 km.).

ERCO.

ENGINEERING & RESEARCH CORPORATION.

HEAD OFFICE AND WORKS: RIVERDALE, MARYLAND.
Chairman of the Board of Directors: H. A. Berliner.
President: L. A. Wells.
Chief Engineer: Fred E. Weick.
Director of Sales: Geo. F. Ryan.
Sales Manager, Aircraft Division: Harry Agerter.

The Engineering and Research Corporation was established in 1930, and manufactures various types of machinery used in aircraft and airscrew production. It has recently begun the manufacture of controllable-pitch airscrews and also undertakes the design and manufacture of light aircraft.

The first aircraft produced by the Company was designed by Mr. Weick and is a two-seat all-metal low-wing cantilever monoplane incorporating a control system which eliminates the necessity for rudder pedals, the aeroplane being flown entirely by the control wheel. This aeroplane, known as the Ercoupe Model 415-C, was introduced on the market in 1940, but production ceased on America's entry into the War, during which the Company was fully engaged in defence contracts. Two Ercoupe Model 415-C monoplanes were acquired by the U.S. Army as prototypes for a radio-controlled target under the designation XPQ-13.

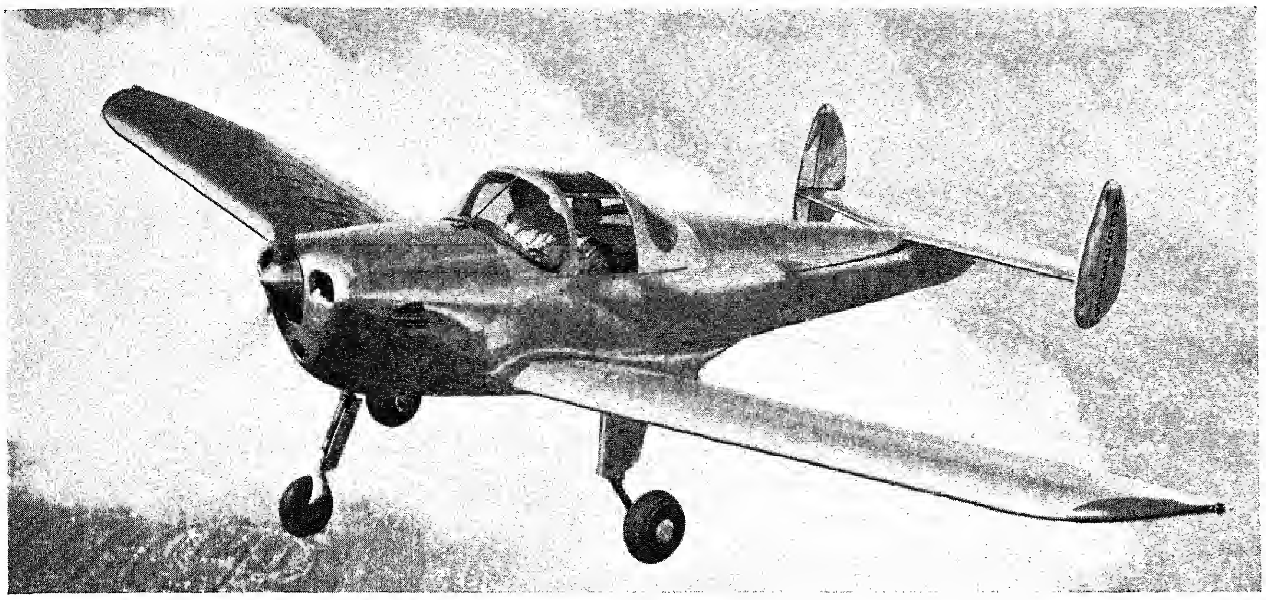
The Ercoupe Model 415-C is now in production again. A licence has been granted to the Aeronca Aircraft Corpn., to build aircraft embodying the Erco "two control" system.

THE ERCOUPE MODEL 415-C.

TYPE.—Two-seat light monoplane.

WINGS.—Cantilever low-wing monoplane. Wings of constant chord and thickness and with dihedral from root. Centre-section built integrally with fuselage. Structure consists of extruded duralumin spars and ribs, the centre-section metal-covered and the outer sections fabric-covered. Chord 5 ft. 0 in. (1.52 m.), Wing area 142.6 sq. ft. (13.2 sq. m.). All-metal ailerons with stressed metal covering.

ERCO—*continued.*



The Ercoupe Model 415-C Two-seat Cabin Monoplane (75 h.p. Continental C75 engine).

FUSELAGE.—All-metal structure with stressed skin covering.

TAIL UNIT.—Cantilever monoplane type with twin fins and rudders. All-metal structure with metal covering throughout.

LANDING GEAR.—Fixed tricycle type. Nose wheel has an Erco oleo shock-absorber unit which permits taxying on air admitted at atmospheric pressure. Main wheels also have Erco shock-absorbers. 12 in. (30.48 cm.) travel on all shock-absorbers. All wheels have low-pressure tyres and main wheels have Goodyear single-disc brakes. Twin Edo Model 1320 floats or tri-ski landing gear with Federal Model 1500 skis optional.

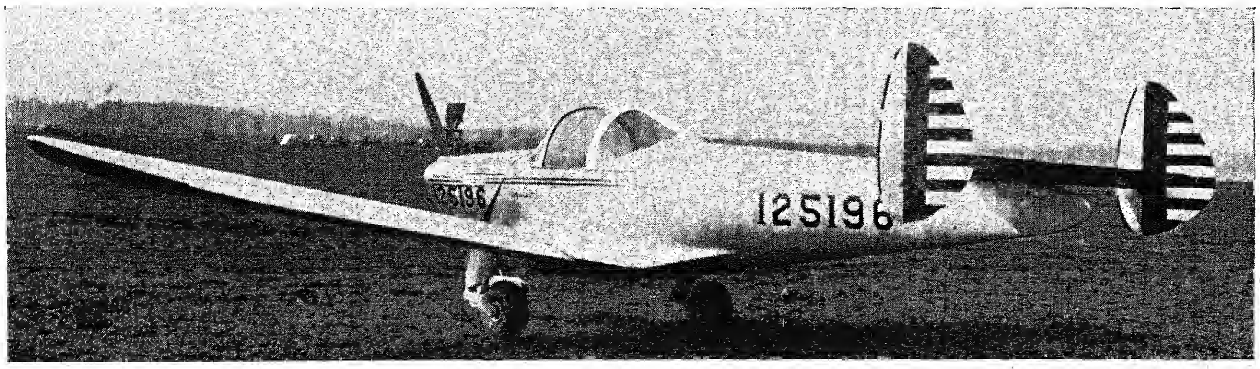
POWER PLANT.—One 75 h.p. Continental C75-12 four-cylinder horizontally-opposed air-cooled engine driving a Sensenich two-blade wooden airscrew. Fuel capacity 23 U.S. gallons (87 litres).

ACCOMMODATION.—Enclosed cockpit seating two side-by-side. Ailerons, rudder and nose wheel are mechanically co-ordinated so that turning in the air and on the ground is accomplished by single wheel control. Rudder pedals may be installed and aileron-rudder connection removed to enable three controls to be used independently if desired. Large luggage compartment aft of cockpit.

DIMENSIONS.—Span 30 ft. (9.14 m.), Length 20 ft. 9 in. (6.32 m.), Height 5 ft. 11 in. (1.80 m.).

WEIGHTS AND LOADINGS.—Weight empty 750 lbs. (340 kg.), Disposable load 510 lbs. (231 kg.), Weight loaded 1,260 lb. (571 kg.), Wing loading 8.8 lb./sq. ft. (42.9 kg./sq. m.), Power loading 16.8 lb./h.p. (7.6 kg./h.p.).

PERFORMANCE.—Maximum speed 127 m.p.h. (240 km.h.), Cruising speed 110 m.p.h. (177 km.h.), Rate of climb (at sea level) 750 ft./min. (229 m./min.), Service ceiling 14,000 ft. (4,265 m.), Maximum range at cruising speed 500 miles (805 km.), Fuel consumption 22 miles per U.S. gallon (35 km. per 3.77 litres).



An Ercoupe Model 415 which was supplied to the U.S. Army as the XPQ-13 experimental radio-controlled Target.

ESHELMAN.

THE CHESTON L. ESHELMAN COMPANY.

HEAD OFFICE: KEYSER BUILDING, BALTIMORE, MD.

President and Secretary: Cheston L. Eshelman.

Vice-President: Sidney S. Zell.

Treasurer: Frank K. Kriz.

The Cheston L. Eshelman Company was formed on January 19, 1942, to undertake the development of aircraft. It has built several experimental aeroplanes of unconventional design, one of which, known as the FW-5, was described in the last issue of "All the World's Aircraft".

The Company's latest production is the E.F.100 Winglet, a description of which follows.

THE ESHELMAN E.F.100 WINGLET.

The Winglet is a two-seat low-wing cabin monoplane of orthodox appearance with a single fin and rudder and a fixed two-wheel landing gear. It embodies a tubular steel spar which serves as a fuel tank, the spar being baffled and the aircraft fuelled at both wing tips.

TYPE.—Two-seat Cabin monoplane.

WINGS.—Cantilever low-wing monoplane. Constant-chord structure consisting of short centre-section and two outer wings. Single tubular metal spar serving as fuel tank; metal ribs and leading-edge, and fabric covering. All-metal ailerons and manually-operated split trailing-edge flaps. Wing area 122 sq. ft. (9.35 sq. m.).

FUSELAGE.—Steel-tube structure with fabric covering.

TAIL UNIT.—Cantilever monoplane type. Metal framework with fabric covering. Trim-tab in each elevator.

LANDING GEAR.—Fixed two-wheel type. Each main wheel (Hayes 7.00 × 4) carried on cantilever oleo shock-absorber leg. Track 9 ft. 5 in. (2.87 m.). Hayes hydraulic brakes and Schenuit tyres. Fixed non-steerable tail-wheel with General tyre.

POWER PLANT.—One Franklin 4A4-100-B-5 four-cylinder horizontally-opposed air-cooled engine rated at 100 h.p. at 2,550 r.p.m. and driving Sensenich two-blade fixed-pitch wooden airscrew. Fuel capacity 25 U.S. gallons (95 litres) contained in main spar. Spar is baffled and refuelled at both wing tips.

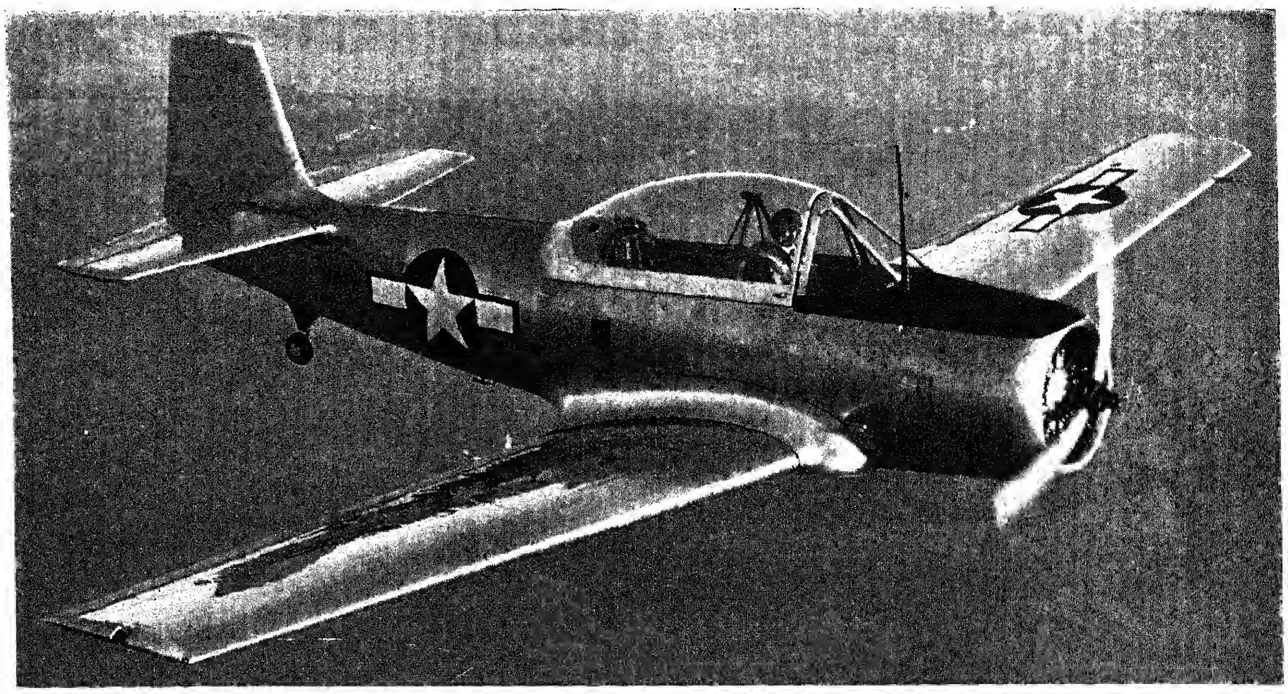
ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Sliding access door on each side. Baggage compartment aft of seat, with allowance of 110 lbs. (50 kg.).

DIMENSIONS.—Span 30 ft. (9.14 m.), Length 18 ft. 11 in. (5.76 m.), Height overall 9 ft. 0 in. (2.74 m.).

WEIGHTS AND LOADINGS.—Weight empty 895 lbs. (405 kg.), Disposable load 615 lbs. (278 kg.), Weight loaded 1,510 lbs. (683 kg.), Wing loading 12.4 lbs./sq. ft. (60.5 kg./sq. m.), Power loading 15.1 lbs./h.p. (6.83 kg./h.p.).

PERFORMANCE.—Maximum speed 135 m.p.h. (217 km.h.), Cruising speed 118 m.p.h. (190 km.h.), Landing speed 55 m.p.h. (88.5 km.h.), Stalling speed 50 m.p.h. (80 km.h.), Initial rate of climb 900 ft./min. (274 m./min.), Service ceiling 15,000 ft. (4,570 m.), Cruising range 496 miles (798 km.), Take-off run 200 yds. (183 m.), Landing run 133 yds. (122 m.).

FAIRCHILD.



The Fairchild XNQ-1 Two-seat Naval Primary Trainer (320 h.p. Lycoming R-680-E engine).

THE FAIRCHILD AIRCRAFT DIVISION OF THE FAIRCHILD ENGINE AND AIRPLANE CORPORATION.

Executive Office: 30, Rockefeller Plaza, New York City, N.Y.

Aircraft Division (C-82 Production): Hagerstown, Md.

Personal Planes Division (Model 24 Production): Dallas, Texas.

Pilotless Planes Division: Farmingdale, Long Island, N.Y.

Chairman of the Board: Sherman M. Fairchild.

President: J. Carlton Ward, Jr.

Vice-President and General Manager: R. S. Boutelle.

Chief Engineer: Armand Thieblot.

Secretary-Treasurer: W. H. Schwebel.

The Fairchild Aircraft Division dates back to 1925 when two groups interested in aircraft manufacture began separate activities which later were to merge and finally become the present organization. In that year the Fairchild Airplane Manufacturing Corpn. and the Kreider-Reisner Aircraft Co. were formed.

The Fairchild Aviation Corpn. of which the Fairchild Airplane Manufacturing Corpn. was a unit, took over the Kreider-Reisner Company in 1929 and when Mr. Sherman Fairchild re-purchased his interests from The Aviation Corpn. in 1931, his interests included the Kreider-Reisner Company. The name of the concern was changed to the Fairchild Aircraft Corpn. in 1935.

In 1936 the Fairchild Engine & Airplane Corpn. was formed to acquire from the Fairchild Aircraft Corpn. its aeroplane and aero-engine manufacturing subsidiaries and in 1939 the Fairchild Aircraft Corpn. became the Fairchild Aircraft Division of the Fairchild Engine and Airplane Corpn.

During the war the Fairchild Aircraft Division was fully engaged in military production and plant facilities were doubled. The Cornell was produced in three versions by five aircraft manufacturers, and up to May, 1944, when production of the Cornell ceased, over 8,000 had been built, 5,000 by the Fairchild Aircraft Division. The Cornell was fully described and illustrated in the last issue of "All the World's Aircraft."

The Fairchild 24 cabin monoplane was supplied to the U.S. Army Air Forces, the U.S. Navy and the Royal Air Force as a light transport and communications type and was known by the Army as the UC-61, the U.S. Navy as the GK-1 and the R.A.F. as the Argus. The post-war Model F-24 is now in production by the Fairchild Personal Planes Division at Dallas, Texas.

The latest products of the company are the C-82A Packet twin-engined cargo transport, which is in production at the Hagerstown plant for the U.S. Army Air Forces, and the XNQ-1 two-seat all-metal training monoplane which has been built for the U.S. Navy.

THE FAIRCHILD XBQ-3.

The XBQ-3 was an experimental long-range aircraft which was designed to carry either one 4,000 lb. (1,816 kg.) or two 2,000 lb. (908 kg.) bombs when flown remotely. Provision was made to carry a ferry crew of two when no bombs were installed. In general arrangement and structure the XBQ-3 was similar to the AT-21 advanced training monoplane described last year.

THE FAIRCHILD XNQ-1.

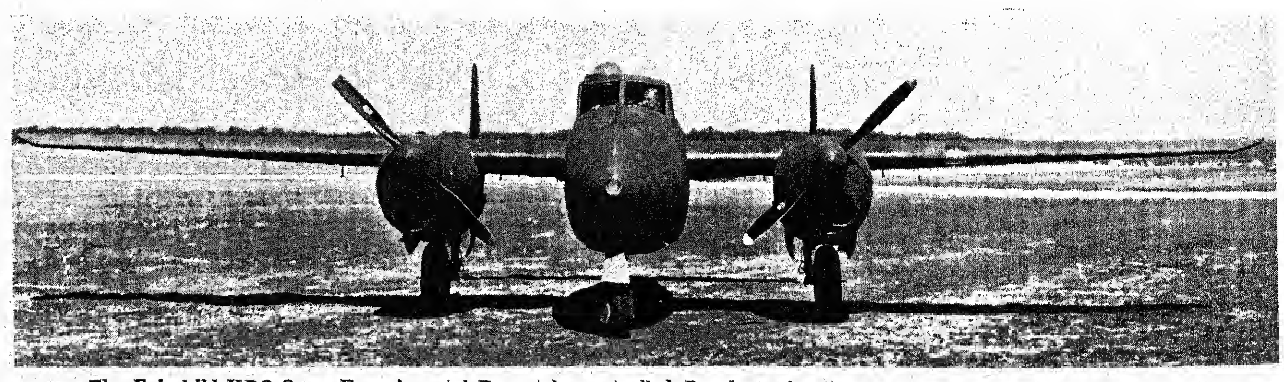
The XNQ-1 is an experimental two-seat primary trainer produced for the U.S. Navy. The prototype aircraft made its first flight on October 18, 1946, at Hagerstown. It is a cantilever low-wing monoplane of all-metal construction and is powered by a 320 h.p. Lycoming nine-cylinder radial air-cooled engine driving a Hamilton Standard two-blade controllable-pitch metal airscrew. An electrically-operated retractable two-wheel landing gear is fitted, and trailing-edge flaps extend between ailerons and fuselage.

The crew of two is accommodated in tandem cockpits covered by a one-piece bubble-type canopy which slides for access. A crash pylon is situated between the cockpits.

Dimensions.—Span 41 ft. 5 in. (12.62 m.), Length 27 ft. 11 in. (8.51 m.), Height 9 ft. 10 in. (3.0 m.).

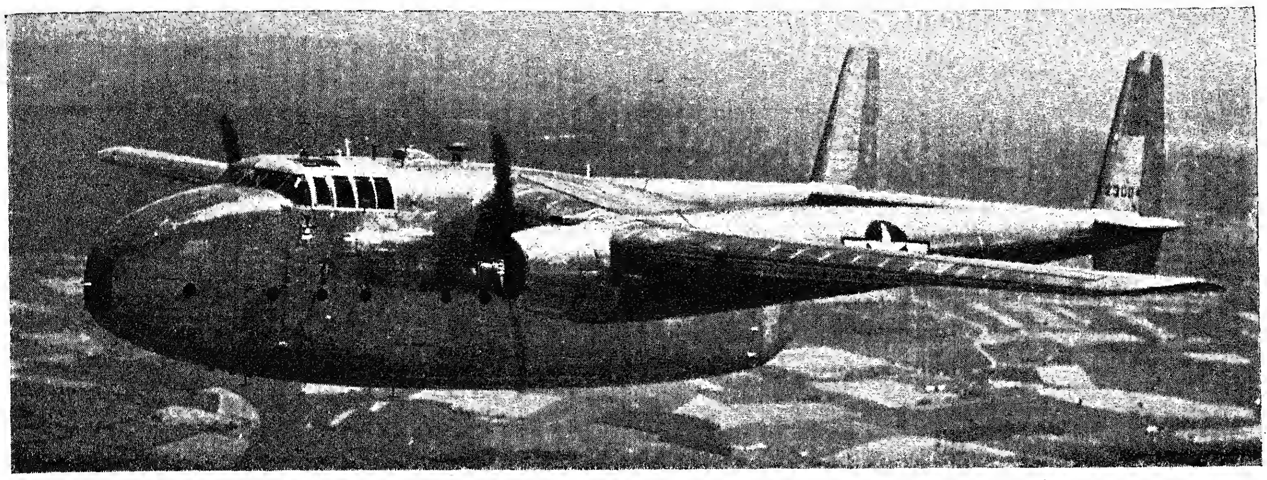
Weight Loaded.—3,700 lbs. (1,678 kg.).

Performance (Estimated).—Maximum speed 170 m.p.h. (274 km.h.), Rate of climb, over 1,000 ft./min. (305 m./min.).



The Fairchild XBQ-3, an Experimental Remotely-controlled Bomb-carrier (two 550 h.p. Ranger V-770-6 engines).

***FAIRCHILD**—continued.*



The Fairchild C-82A Packet Military Transport (two 2,100 h.p. Pratt & Whitney R-2800-85 engines).

THE FAIRCHILD MODEL F-78 PACKET.

U.S. Army Air Forces designation : C-82A.

The original design of the XC-82 was begun in 1941 and the design and mock-up were approved by the U.S. Army in 1942. Tho actual detailed development and engineering, including the construction and preliminary testing of the prototype, which first flew on September 10, 1944, took less than 21 months.

The C-82A was put into production by both Fairchild and North American Aviation, Inc. but at the end of the war the Fairchild contract was reduced by 80%, and the North American contract was cancelled. The Packet may later be available for commercial use.

TYPE.—Twin-engined Cargo or Troop Transport.

WINGS.—Cantilever high-wing monoplane. Two-spar structure in three main sections consisting of anhedral centre-section let into fuselage and carrying engine nacelles and tail-booms, and two outer wings. Detachable tips. Centre-section and outer wings each in three main sections comprising leading-edge, inter-spar section and trailing-edge. Two-spar all metal structure. Built-up I-section front and rear spars of extruded T-section top and bottom booms with plate-webs and rolled vertical stiffeners. Ribs of pressed light-alloy and built-up web beams. Spanwise stringers and stressed Alclad skin. Outer wings and undersurface of centre-section reinforced by corrugated sheet beneath outer skin. Centre-section span 34 ft. 2 in. (10.4 m.); wing root chord 17 ft. 10 in. (5.43 m.); tip chord 8 ft. 11 in. (2.72 m.); wing area (less ailerons) 1,288.7 sq. ft. (119.7 sq. m.); gross wing area 1,400 sq. ft. (130.9 sq. m.). Metal ailerons on outer wings in two sections each side arranged to droop with flaps. Pressed channel-section spar and nose and tail-ribs, with metal skin over leading-edge and fabric covering aft. Aileron span 25 ft. 1¼ in. (7.64 m.). Controllable trim-tab in inner section of port aileron has span of 4 ft. 0⅛ in. (1.22 m.). Electrically-operated NACA slotted trailing-edge flaps between ailerons and fuselage divided by tail-booms. Flaps constructed as ailerons but with all-metal covering. Outer flap span 7 ft. 8½ in. (2.35 m.); inner flap span 5 ft. 10⅛ in. (1.78 m.); maximum depression 40 degrees.

FUSELAGE.—All-metal semi-monocoque structure, in six main sections comprising main body, sides, upper front, upper rear, nose compartment, and rear cargo door compartments. Structure consists of Alclad vertical frames, longitudinal stringers and longitudinal and transverse beams, with smooth Alclad skin. Seven longitudinal beams take tho floor and tie-down loads beneath a ply covered floor. Rear compartment is split on vertical centre-line, the halves hinging outwards to allow direct loading of freight. Length of fuselage 54 ft. 0 in. (16.46 m.); maximum width 10 ft. 4$\frac{3}{32}$ in. (3.15 m.); maximum depth 13 ft. 6 in. (4.11 m.).

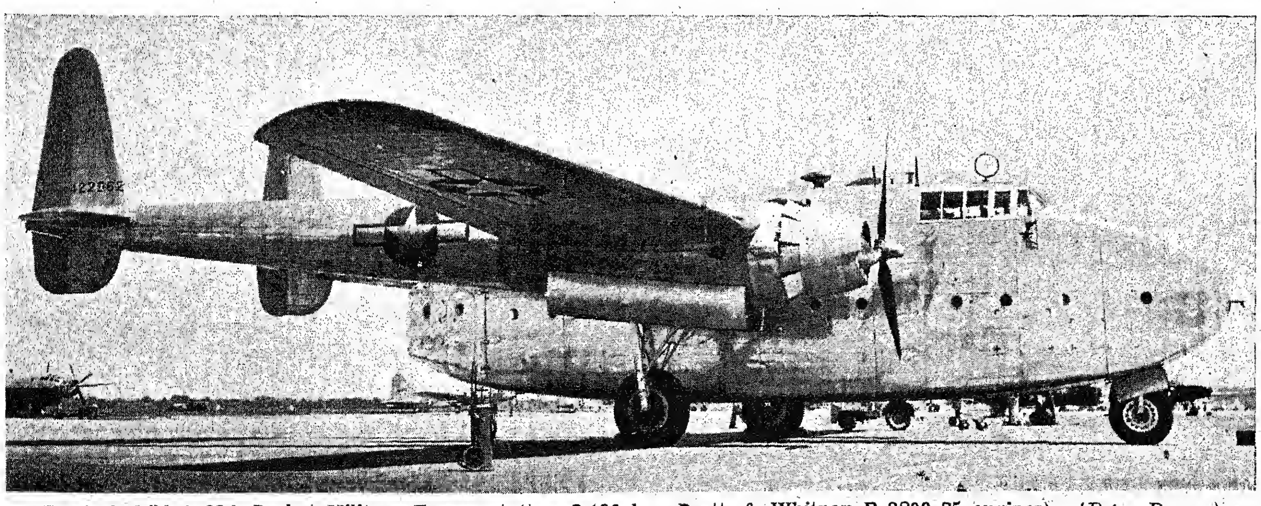
TAIL BOOMS.—All-metal structures of circular cross-section forward tapering to oval-section aft. Each in two main sections. Forward section is of semi-monocoque construction with pressed light alloy channel-sections frames, top-hat section longitudinal stringers and light-alloy skin. Forward section bolted to engine nacelle structure aft of trailing-edge. Aft section is similarly constructed with heavy frames and bulkheads and stressed light alloy skin, and is bolted to forward section at leading-edge of tailplane.

TAIL UNIT.—Cantilever monoplane type with twin fins and rudders extending above and slightly below tail-booms. All-metal structures. Tailplane and fins each have two light-alloy spars pressed chordwise ribs and stressed metal skin. One-piece metal-framed elevator and rudders each have single spar, metal nose and fabric covering over all. Controllable elevator trim-tab each side of centre-line and in each rudder. Tailplane span (overall) 36 ft. 4 in. (11.07 m.); elevator span 26 ft. 8¼ in. (8.14 m.); total elevator tab span 15 ft. 5¼ in. (4.70 m.); rudder height (overall) 16 ft. 8 in. (5.08 m.); maximum rudder chord 8 ft. 1½ in. (2.46 m.); rudder tab height 4 ft. 8$\frac{23}{32}$ in. (1.43 m.).

LANDING GEAR.—Retractable tricycle type. Each main wheel 4 ft. 8 in. (1.44 m.) diameter carried between pair of oleo shock-absorber legs which retract into engine nacelles and are enclosed by twin doors. Nose-wheel carried in half-fork on oleo shock-absorber leg retracts into nose and is enclosed by twin doors. Hydraulic operation, and emergency lowering gear. Track 28 ft. 3⅜ in. (8.62 m.). Hydraulic brakes on main wheels.

POWER PLANT.—Two Pratt & Whitney R-2800-85 eighteen-cylinder two-row radial air-cooled engines each rated at 1,700 h.p. at 2,600 r.p.m. and developing 2,100 h.p. at 2,800 r.p.m. for take-off. Enclosed in tapered long-chord NACA cowlings with controllable trailing-edge gills and mounted on steel-tube bearers in monocoque nacelles terminating in tail-booms. Hamilton Standard Hydromatic three-blade full-feathering airscrews, 15 ft. 2 in. (4.62 m.) diameter. Ground clearance 2 ft. 10 in. (0.86 m.). Four fuel tanks in outer wings between spars. Oil tank of 55 U.S. gallons (208 litres) capacity in each nacelle.

ACCOMMODATION.—Flight deck has two seats side-by-side for pilot (on port) and co-pilot; navigator on centrally-placed seat facing to starboard with table behind co-pilot's seat, and radio-operator's position on port side aft of navigator. Auxiliary flight deck aft of main flight deck accommodates radio equipment. Access ladder on port side of main compartment with hatch leading to flight deck. Emergency escape hatch in roof. Main cargo compartment has maximum length of 38 ft. 6 in. (11.73 m.); width of 8 ft. 8 in. (2.64 m.); height (under cockpit) of 6 ft. 3 in. (1.9 m).



The Fairchild C-82A Packet Military Transport (two 2,100 h.p. Pratt & Whitney R-2800-85 engines).—(*Peter Bowers*).

FAIRCHILD—*continued.*

and height aft of 8 ft. 5 in. (2.56 m.). Capacity 2,870 cub. ft. (81.2 cub. m.). 42 folding canvas side-seats in troop transport version. Seats removable and entire space can be used for freight transport. Floor is reinforced to take heavy loads and provided with tie-down rings. For ambulance duties provision is made for 34 litters and 5 attendants; 22 litters, 22 seated patients and 3 attendants, or 13 litters, 40 seated patients and 2 attendants. Auxiliary compartment 5 ft. $11\frac{3}{4}$ in. long × 4 ft. $5\frac{1}{2}$ in. wide × 1 ft. 7 in. deep (1.82 m. × 1.36 m. × 0.48 m.) under floor allows containers to be delivered by parachute. Rear cargo doors open vertically on centre-line and provide loading area 8 ft. × 8 ft. (2.44 m. × 2.44 m.). Adjustable ramps permit vehicles to be driven in, and freight can be loaded from bed of truck. Forward access door 6 ft. $2\frac{1}{2}$ in. × 3 ft. 2 in. (1.89 m. × 0.96 m.) on port side. The Packet has been demonstrated as a "Flying mail-car" with facilities for sorting mail during flight.

EQUIPMENT.—24-volt electric system. Radio equipment consists of ten receivers and six transmitters accommodated on auxiliary flight deck. Individual oxygen equipment for crew and troops. Automatically-inflatable six-man life-raft in upper rear fuselage section.

DIMENSIONS.—Span 106 ft. $5\frac{1}{32}$ in. (32.44 m.), Length overall 77 ft. 1 in. (23.49 m.), Height overall 26 ft. $4\frac{1}{16}$ in. (8.03 m.).

WEIGHTS AND LOADINGS.—Weight empty 28,000 lbs. (12,700 kg.), Disposable load 22,000 lbs. (9,980 kg.), Weight loaded 50,000 ft. (22,680 kg.), Payload (500 miles=805 km.) 18,000 lbs. (8,165 kg.), Payload (1,000 miles=1,609 km.) 15,500 lbs. (7,031 kg.), Payload (1,500 miles = 2,414 km.) 13,000 lbs. (5,897 kg.), Wing loading 35.7 lbs./sq. ft. (174.3 kg./sq. m.), Power loading at take-off 11.9 lbs./h.p. (5.38 lbs./h.p.).

PERFORMANCE.—Cruising speed, over 200 m.p.h. (322 km.h.), Service ceiling 25,000 ft. (7,620 m.), One-engine ceiling 8,000 ft. (2,440 m.), Maximum range 4,000 miles (6,437 km.), Take-off run 267 yds. (244 m.).

THE FAIRCHILD MODEL F-47.

The F-47 is a conventional all-metal four-seat low-wing cabin monoplane which is under development for ultimate production at the new Personal Planes Division recently acquired at Strother Field, Windfield, Kansas. The F-47 will be fitted with a 185 h.p. Continental engine and will have a cruising speed of about 150 m.p.h. (240 km.h.). No further details of this aircraftt were available for publication at the time of writing.

THE FAIRCHILD MODEL F-24.

The Model 24 was originally produced in 1933 as a four-seat light cabin monoplane. In 1942 it was adopted by the Royal Air Force for communications duties and named the Argus, and later was also issued to the U.S.A.A.F. and U.S. Navy as the UC-61 and GK-1 Forwarder respectively. Details of the various versions were given in the last issue of "All the World's Aircraft". The current production models are intended for civilian use and are designated the F-24R46 (Ranger engine) and the F-24W46 (Warner engine). The following specification refers to these versions.

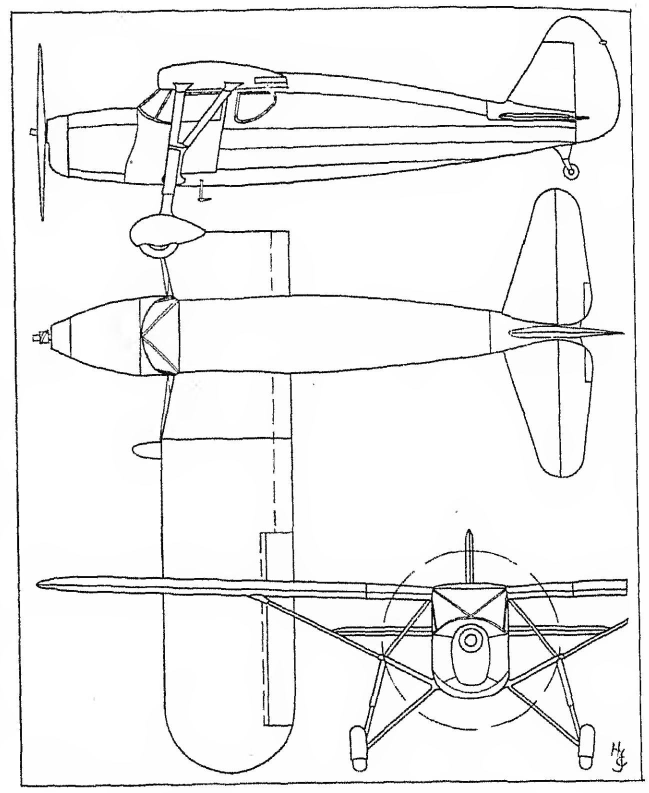
TYPE.—Four-seat Cabin Monoplane.

WINGS.—Strut-braced high-wing monoplane. Aerofoil section No. 22. Two-spar structure in two main sections attached to top fuselage longerons and braced to bottom fuselage longerons by steel-tube V-struts. Wings taper in plan and thickness at fuselage. Spruce spars and ribs, duralumin and steel-tube compression ribs and wire drag-bracing, plywood leading-edge and fabric covering. Frise-type statically-balanced ailerons have built-up aluminium alloy frames and fabric covering. Split trailing-edge flaps between ailerons and fuselage having aluminium-alloy and wood frames and aluminium sheet covering. Gross wing area 193.3 sq. ft. (185 sq. m.).

FUSELAGE.—Rectangular-section welded steel-tube structure, with light fairing frames, longitudinal stringers and fabric covering.

TAIL UNIT.—Cantilever monoplane type. Fin and tailplane have wooden spars and plywood covering. Rudder and elevators have welded steel-tube frames and are fabric covered. Horn-balanced rudder. Adjustable trim-tab in each elevator. Tailplane span 12 ft. $1\frac{5}{8}$ in. (3.70 m.).

LANDING GEAR.—Fixed two-wheel divided type. Each unit consists of a Fairchild oleo shock-absorber leg with 8 in. (20.3 c/m.) travel



The Fairchild F-24R46 Cabin Monoplane.

attached to front wing bracing strut and braced to top fuselage longeron, and attached by steel-tube axle to bottom longeron. Medium-pressure tyres and wheel brakes. Track 9 ft. 3 in. (2.82 m.). Steerable oleo-spring tail-wheel.

POWER PLANT.—One 175 h.p. Ranger 6-440-C2 six-cylinder in-line inverted air-cooled engine, or one 165 h.p. Warner Super-Scarab seven-cylinder radial air-cooled engine. Sensenich two-blade fixed-pitch wooden airscrew. Two fuel tanks, one in each wing root, with total capacity of 60 U.S. gallons (226 litres); oil capacity 4 U.S. gallons (15 litres).

ACCOMMODATION.—Enclosed cabin seating four; two single seats in front with removable dual controls, and full-width seat aft. Access door on each side. Baggage compartment of 9 cub. ft. (0.25 cub. m.) capacity aft of seats (allowance 140 lbs.(62 kg.).

DIMENSIONS.—Span 36 ft. 4 in. (11.7 m.), Length 25 ft. $10\frac{1}{4}$ in. (7.87 m.), Height 7 ft. $7\frac{1}{2}$ in. (2.30 m.).

WEIGHTS AND LOADINGS (F-24R46).—Weight empty 1,650 lbs. (748 kg.), Weight loaded 2,562 lbs. (1,162 kg.), Wing loading 13.27 lbs./h.p. (64.8 kg./sq. m.), Power loading 14.6 lbs./h.p. (6.6 kg./h.p.).

WEIGHTS AND LOADINGS (F-24W46).—Weight empty 1,613 lbs. (732 kg.), Weight loaded 2,562 lbs. (1,162 kg.), Wing loading 13.27 lbs./h.p. (64.8 kg./sq. m.), Power loading 15.3 lbs./h.p. (6.9 kg./h.p.).

PERFORMANCE (F-24R46).—Maximum speed at sea level 133 m.p.h. (214 km.h.), Cruising speed (75% power) 118 m.p.h. (190 km.h.), Landing speed (without flaps) 57 m.p.h. (92 km.h.), Landing speed (with flaps) 53 m.p.h. (85 km.h.), Service ceiling 14,000 ft. (4,267 m.), Maximum range 620 miles (998 km.), Maximum duration 5.25 hrs., Take-off distance to 50 ft. (15 m.) 1,100 ft. (335 m.), Landing distance from 50 ft. (15 m.) 1,000 ft. (305 m.).

PERFORMANCE (F-24W46).—As F-24R46 except—Maximum speed at sea level 132 m.p.h. (212.4 km.h.), Cruising speed (75% power) 117 m.p.h. (188 km.h.), Maximum range 639 miles (1,028 km.), Maximum duration 5.75 hrs.

FIRESTONE (formerly G. & A.)

FIRESTONE AIRCRAFT COMPANY.

HEAD OFFICE AND WORKS: WILLOW GROVE, PA.

President: Roger S. Firestone.
Vice-President and General Manager: R. H. Isbrandt.
Treasurer: R. A. Firestone.
Secretary: H. S. Brainard.
Assistant Secretary and Treasurer: H. W. Hooper.
Chief Engineer: J. P. Perry.

G & A Aircraft, Inc. (formerly the AGA Aviation Corporation) was the successor to the Pitcairn-Larsen Autogiro Co., Inc., which, in 1940, took over the plant and all existing contracts of the original Pitcairn Autogiro Company.

In 1943 G & A Aircraft, Inc., was acquired by the Firestone Aircraft Company of Akron, Ohio, a subsidiary of the Firestone Tire and Rubber Company. Nearly 200 patents concerned with developments in rotary wing aircraft, covering both autogiros, for which the Company holds manufacturing rights from the Autogiro Corporation of America, and helicopters, were included in the transfer.

In 1946 the name of the company was changed from G. & A. Aircraft, Inc. to the Firestone Aircraft Company.

During the War G & A Aircraft, Inc., produced more than 600 Waco CG-4A cargo-carrying gliders and several experimental rotary wing aircraft for the U.S. Government. It also undertook extensive sub-contract work for other aircraft manufacturers.

The latest products of the Company are the XR-9B two-seat military helicopter, and the GA-45D, a commercial development of the XR-9B.

THE FIRESTONE MODEL 45C.

U.S. Army Air Forces designation: XR-9B.

The XR-9B was developed by G. & A. Aircraft in co-operation with the A.A.F. Air Technical Service Command. Design work on the prototype (XR-9) began in 1943 and it flew in 1944 as a single-seat aircraft. Later it was converted to accommodate a crew of two seated in tandem, and has since been further modified to incorporate a widened cabin to seat two side-by-side. This last-mentioned version is being introduced as a commercial helicopter as the Model 45D.

The Firestone XR-9B Two-seat Military Helicopter (135 h.p. Lycoming O-290-7 engine).—(*Peter Bowers*).

TYPE.—Two-seat Helicopter.

ROTORS.—One three-blade main rotor and one three-blade vertical controllable-pitch anti-torque and steering rotor carried on boom extending rearwards from fuselage. Main rotor of NACA aerofoil section constructed of step-tapered heat-treated steel-tube spars with $\frac{7}{32}$ in. (.55 cm.) five-ply poplar ribs attached by stainless steel collars. Leading-edgo strips of spruce over inboard half of blade, and maple over outboard half, with embedded lead ballast. Spruce trailing-edge strips. Covering of $\frac{1}{32}$ in. (0.078 cm.), three ply mahogany with poplar core, with doped fabric over all. Main rotor diameter 28 ft. (8.53 m.); root chord 1 ft. $3\frac{1}{4}$ ins. (.38 m.); tip chord 0 ft. $8\frac{1}{2}$ in. (22 cm.); area (each) 12.5 sq. ft. (1.16 sq. m.). Main blades removable to facilitate stowage and transport. Tail rotor of similar construction, with NACA aerofoil section. Diameter 6 ft. 6 in. (1.98 m.); root chord 0 ft. $6\frac{1}{2}$ in. (16.47 cm.); tip chord 0 ft. $3\frac{7}{8}$ in. (9.84 cm.); blade area (each) 1,125 sq. ft. (114 sq. m.).

FUSELAGE.—Welded steel-tube structure with sheet aluminium alloy covering. Boom carrying tail rotor has balsa core and Alclad skin, and is attached to forward fuselage by six bolts. Rear boom detachable for transport, etc.

LANDING GEAR.—Fixed tricyclo type. Each main wheel carried on shock-absorber leg braced to fuselago by steel-tube V-struts. Track 9 ft. 0 in. (2.74 m.). Steerable noso-wheel carried in half fork on shock absorber log. Emergency bumper-skid extends downward from rear of boom.

POWER PLANT.—One 135 h.p. Lycoming O-290-7 four-cylinder horizontally-opposed air-cooled engine mounted in fuselage aft of cabin. Two removable panels on each side of fuselage allow access to engine and transmission. Maximum fuel capacity 25 U.S. gallons (94 litres). 80 Octane fuel.

ACCOMMODATION.—Lucite transparent nose-section accommodates crew of two in tandem. Entry door on starboard. Dual controls, consisting of conventional control column effecting cyclic pitch control for horizontal travel, and rudder pedals operating tail rotor for directional heading. Vertical flight control by simultaneous pitch control and throttle. Electro-hydraulic governor allows control solely by throttlo.

DIMENSIONS.—Main rotor diameter 28 ft. 0 in. (8.53 m.), Length 27 ft. 7 in. (8.40 m.), Height 8 ft. $6\frac{1}{2}$ in. (2.60 m.).

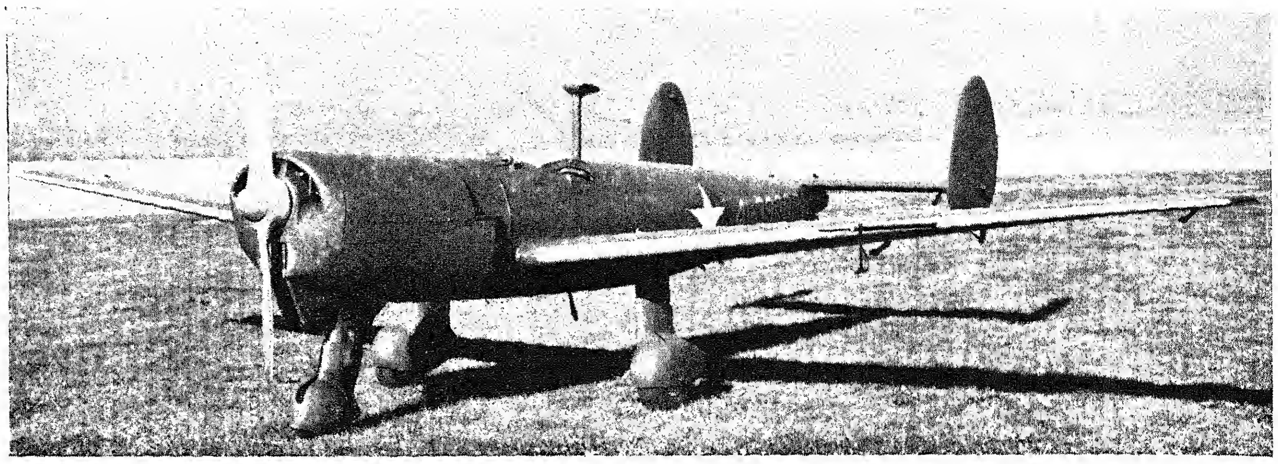
WEIGHT LOADED.—1,750 lbs. (795 kg.).

PERFORMANCE (Estimated).—Maximum speed over 100 m.p.h. (161 km.h.), Cruising speed 80 m.p.h. (129 km.h.), Service ceiling over 10,000 ft. (3,050 m.), Rate of climb 1,000 ft./min. (305 m./min.).

The Firestone XR-9B Military Helicopter.

The Firestone GA-45D Two-seat Commercial Helicopter (135 h.p. Lycoming engine).—(*Martin & Kelman*).

FLEETWINGS.



The Fleetwings YPQ-12A Radio-controlled Target or Bomb-carrier (Lycoming O-435 engine). The open cockpit was for test and ferrying.

FLEETWINGS DIVISION OF KAISER CARGO, INC.

Head Office and Works: Bristol, Pennsylvania.
President: E. E. Trefethen, Jr.
Vice-President and General Manager: S. D. Hackley.
Manager: J. L. McClane.
Executive Assistant to Vice-President: F. R. Browning.
Controller: F. L. Wilmoth.
Chief Engineer: G. G Cudhea.
Research Engineer: Carl de Ganahl.

Fleetwings, Inc., was organized in 1929 and has been engaged continuously in design and research work in stainless-steel construction. In 1934, the firm acquired its present works, formerly belonging to the Keystone Aircraft Corporation.

Up to 1939 the Company devoted its efforts largely to research work but since that time it has actively entered the manufacturing field and during the war fulfilled contracts for the U.S. Army and Navy and sub-contracts for such firms as the Curtiss-Wright Corpn., the Republic Aviation Corpn., the Douglas Aircraft Company, the Vought and Sikorsky Aircraft Divisions of the United Aircraft Corpn., the Brewster Aeronautical Corpn., Grumman Aircraft Engineering Corpn. and others.

In addition, it has developed several experimental aircraft for the U.S. Army and Navy, including the XBQ-2 and XBQ-2A radio-controlled pilotless bomb-carriers and the XPQ-12, XPQ-12A radio-controlled targets for the U.S.A.A.F., and the XBTK-1 single-seat Bomber-Torpedo monoplane for the U.S. Navy. The Fleetwings BT-12 trainer of stainless-steel construction was last described in the 1942 issue of this Annual.

In March, 1943, Mr. Henry J. Kaiser, the famous shipbuilder, acquired Fleetwings Inc., which is now operating as a Division of Kaiser Cargo, Inc. of Oakland, Cal. Kaiser Cargo, Inc. was formed in November, 1942, as a subsidiary of the Henry J. Kaiser Company, the shipbuilding organization.

The Fleetwings Division continues to work on confidential work for the U.S. Navy.

Fleetwings is also engaged in producing various items of machinery for domestic purposes.

THE FLEETWINGS YPQ-12A.

The YPQ-12A was a single-engined radio-controlled target aircraft which was developed from the original XPQ-12 design and was ordered on a limited procurement order for service trials. Eight were built before a cancellation of the contract.

It was a low-wing monoplane with fixed tricycle landing-gear, and twin-ruddered tail unit and was fitted with a Lycoming O-435 horizontally-opposed air-cooled engine. A single cockpit with conventional controls was provided for ferry flights and testing, but normally the aircraft was intended to be flown without pilot and be controlled remotely by radio either from a target control aircraft or from the ground.

The YPQ-12A also had provision for carrying one 500 lb. (227 kg.) bomb so that it could be used as a radio controlled pilotless bomb-carrier or guided missile.

Dimensions.—Span 30 ft. 0¾ in. (9.2 m.), Length 20 ft. 0¼ in. (6.1 m.), Height 7 ft. 0 in. (2.13 m.).

Weights.—Weight loaded (with pilot for ferrying or test) 2,196 lbs. (997 kg.), Weight loaded (as pilotless bomb-carrier) 2,688 lbs. (1,220 kg.).

Performance.—Maximum speed (as pilotless target) 185 m.p.h. (296 km.h.).

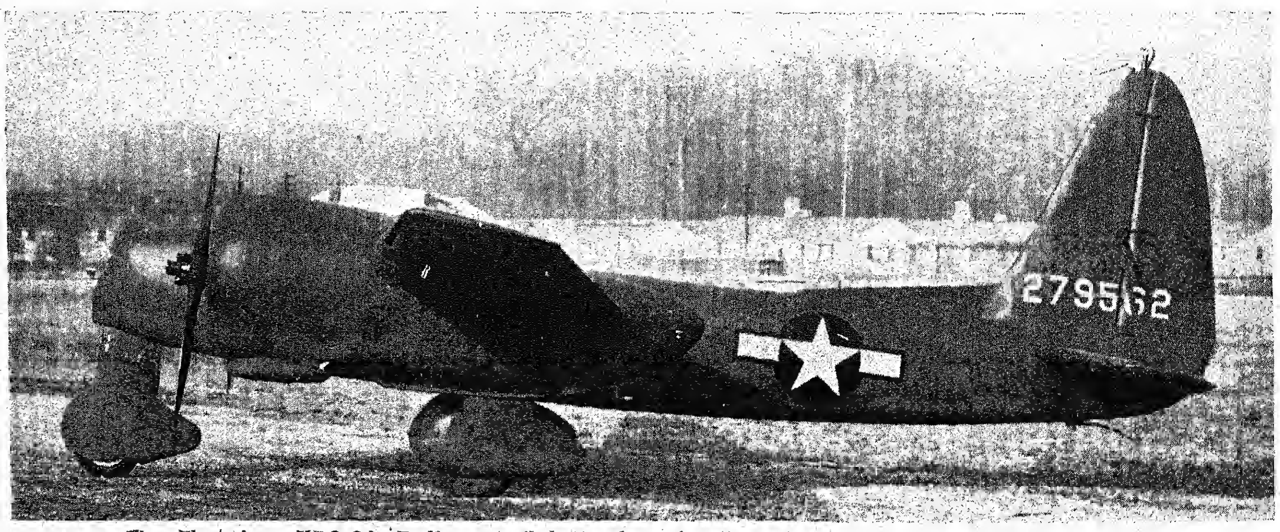
THE FLEETWINGS XBQ-2.

The XBQ-2 was an experimental ground-launched radio-controlled pilotless bomb-carrier or guided missile with provision for carrying 2,000 lbs. (908 kg.) of H.E. It was a twin-engined monoplane of wood and fabric construction and was fitted with a jettisonable landing-gear. Originally designed for two 185 h.p. Lycoming O-435 engines, the final installation in the XBQ-2A consisted of two 280 h.p. Lycoming R-680 radials. The general arrangement of the XBQ-2A can be gathered from the accompanying illustration.

Dimensions.—Span 48 ft. 2 in. (14.7 m.), Length 27 ft. 9 in. (8.4 m.), Height 13 ft. 2 in. (4 m.).

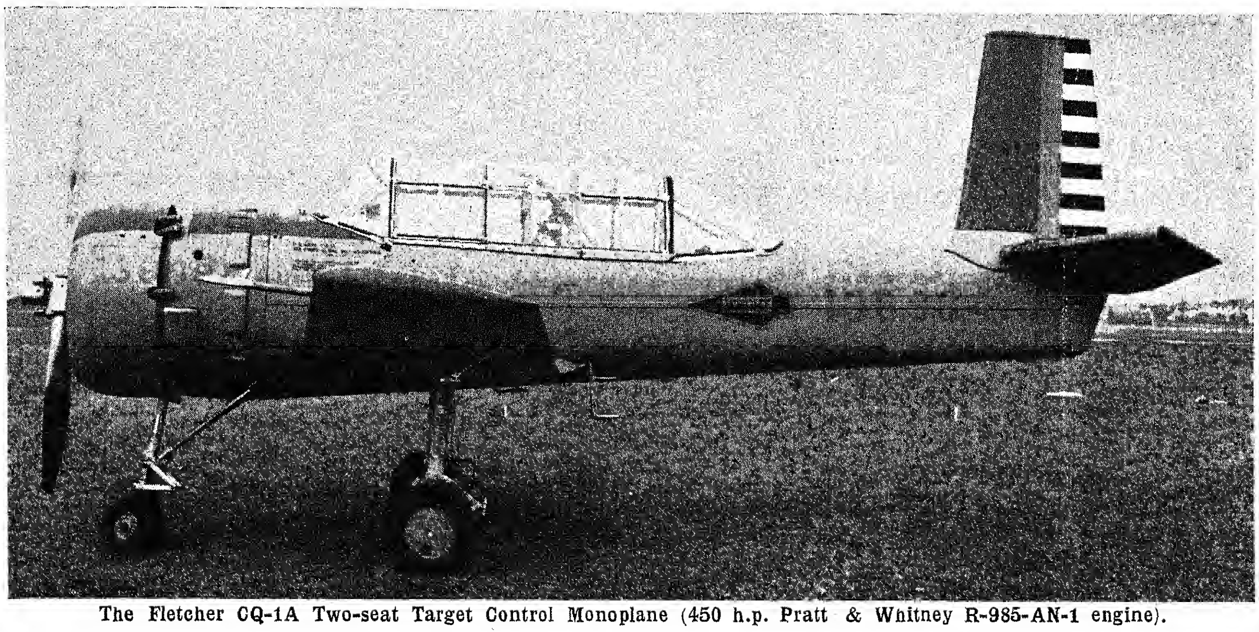
Weight Loaded.—8,020 lbs. (3,640 kg.).

Performance.—Maximum speed 204 m.p.h. (326 km.h.).



The Fleetwings XBQ-2A Radio-controlled Bomb-carrier (two 280 h.p. Lycoming R-680-13 engines).

FLETCHER.



The Fletcher CQ-1A Two-seat Target Control Monoplane (450 h.p. Pratt & Whitney R-985-AN-1 engine).

FLETCHER AVIATION CORPORATION.

Head Office and Works : Pasadena, Cal.

President and Chief Engineer : Wendell S. Fletcher.

Vice-President : Frank P. Fletcher.

Secretary and Treasurer : Maurice C. Fletcher.

The Fletcher Aviation Corpn. entered the aircraft manufacturing field in 1941 with a two-seat primary trainer employing a plastic-plywood construction and incorporating symmetrical wings and control surfaces to provide complete interchangeability of wings, flaps, ailerons and tail-surfaces. This aircraft the FBT-2, has been described in previous issues of this Annual.

The Fletcher Aviation Corpn. was almost exclusively engaged in the manufacture of plastic plywood aircraft, components, parts and assemblies for various aspects of the War effort.

Included in the various aircraft projects developed by the Company during the war were the XCQ-1 and CQ-1A two-seat Target Control aircraft, both fitted with a 450 h.p. Pratt & Whitney R-985 engine. Built mainly of so-called non-strategic materials, the XCQ-1 and 1A had accommodation for pilot and air operator for the remote control by radio of pilotless target aircraft. The CQ-1A, which differed from its predecessor by being fitted with unprotected fuel tanks, is shown in the accompanying illustration. This type did not reach the production stage as standard types of existing aircraft were eventually adapted for target control duties. These included the CQ-2, an adaptation of the Vultee L-1A, and the CQ-3, a version of the Beechcraft C-45 fitted with radio equipment for controlling the Culver PQ-14.

Fletcher also designed the PQ-11 and PQ-11A Target Drones, but orders for these were cancelled before any aircraft were built. The PQ-11 was also proposed as a remotely-controlled Bomb carrier under the designation XBG-1.

The Company is now engaged in developing a series of post-war all-metal civil aircraft.

FRANKFORT.

THE GLOBE CORPORATION, AIRCRAFT DIVISION (formerly Frankfort Sailplane Company).

Head Office and Works : Box 922, Joliet, Ill.

President : George F. Getz, Jr.

Vice-President and General Manager : Russell E. Gage.

Secretary : Robert N. Little.

Treasurer : Bruce C. Hightower.

Before the war the Frankfort Sailplane Co., now the Aircraft Division of the Globe Corpn., built gliders, its most successful product being the Cinema two-seat model which proved its efficiency in various national competitions. As the TG-1 it was used by the U.S. Army as a training glider.

Between 1942 and 1945 the Globe Corporation shared with the Radioplane company the entire production of the Radioplane OQ-2A (TDD-1), OQ-3 (TDD-2) and OQ-14 (TDD-3) light aerial targets for the U.S. Army and Navy. In all, nearly 14,000 were built. The Radioplane OQ targets were 12 ft. (3.66 m.) span models fitted with small 20 h.p. Righter two-cylinder two-stroke engines. They were catapulted into flight and controlled by radio from the ground or ship to provide suitable targets for anti-aircraft gunners. If hit and not destroyed, a solenoid device released a parachute and stopped the engine so that the target could be salved and returnod to service. The OQ-2A, which had contra-rotating airscrews, had a speed of 85 m.p.h. (136 km.h.) and the OQ-3 and OQ-14, which had single airscrews, had speeds of 103 and 141 m.p.h. (165 and 226 km.h.) respectively.

FUNK.

FUNK AIRCRAFT COMPANY.

Head Office and Works : R.F.D. No. 5, Coffeyville, Kansas.

Sales Manager : N. F. Howard.

Chief Engineer : H. C. Funk.

Production Manager : J. C. Funk.

The Funk Aircraft Co. is the successor to Akron Aircraft, Inc., which was formed by the brothers Funk in 1939 to place on the market a light two-seat cabin monoplane known as the Model B.

Since the war the company has resumed production with the Funk B-85-C, which is basically the same as the pre-war Model B except that it is now fitted with an 85 h.p. Continental engine in place of the 75 h.p. Lycoming and has other small refinements.

THE FUNK MODEL B-85-C BEE.

Type.—Two-seat Cabin monoplane.

Wings.—Strut-braced high-wing monoplane. Aerofoil section NACA 4412. Two-spar structure in two main sections attached to fuselage and braced to lower longerons by parallel struts each side. Solid wood spars, truss-type wood ribs and fabric covering. Wing area 169 sq. ft. (15.69 sq. m.).

Fuselage.—Welded steel-tube structure with wooden fairing and fabric covering.

Tail Unit.—Wire-braced monoplane type. Steel-tube construction with fabric covering.

Landing Gear.—Fixed two-wheel type, consisting of two hydraulic-spring side Vees and half-axles attached to bottom centre-line of fuselago. Steerable full-swivelling tail-wheel on hydraulic shock-absorber. Track 6 ft. (1.83 m.).

Power Plant.—One 85 h.p. Continental C85-12 four-cylinder horizontally-opposed air-cooled engine driving a Lewis two-blade fixed-pitch airscrew. Fuel capacity 20 U.S. gallons (76 litres).

Accommodation.—Enclosed and sound-proofed cabin seating two side-by-side with dual controls. Access door on each side with adjustable windows. Baggage compartment of 7.5 cub. ft. (0.21 cub. m.) capacity aft of seats ; allowance 50 lbs. (22.7 kg.).

Dimensions.—Span 35 ft. 0 in. (10.66 m.). Length 20 ft. 5 in. (6.25 m.), Height 6 ft. 1 in. (1.85 m.).

Weights and Loadings.—Weight empty 880 lbs. (399 kg.), Disposable load 470 lbs. (213 kg.), Weight loaded 1,350 lbs. (612 kg.), Wing loading 8 lbs./sq. ft. (39.06 kg./sq. m.), Power loading 15.9 lbs./h.p. (7.2 kg./h.p.).

Performance.—Maximum speed 112 m.p.h. (180 km.h.) at sea level, Cruising speed 100 m.p.h. (161 km.h.), Landing speed 37 m.p.h. (60 km.h.), Rate of climb 800 ft./min. (244 m./min.), Service ceiling 15,000 ft. (4,570 m.), Range (with ½-hr. reserve) 400 miles (644 km.), Take-off run at sea level 133 yds. (122 m.), Cruising consumption 5 U.S. gallons per hr. (18.9 litres per hr.).

The Globe Swift GC-1A Two-seat Cabin Monoplane (85 h.p. Continental C85-12 engine).—(*William T. Larkins*).

GLOBE AIRCRAFT CORPORATION.

Head Office and Works: North Side Station, Fort Worth, Texas.

President: John Kennedy.
Vice-President: Norman Nicholson.
Vice-President in charge of Engineering: H. K. Knox.
Vice-President in charge of Production: J. F. Steppe.
Assistant Vice-Presidents: W. G. Fuller and J. M. Shirkey.
Secretary: Willard Nelson.
Treasurer and Director: N. N. Oille.

This Company was originally formed as the Bennett Aircraft Corporation to manufacture aircraft employing the use of Duraloid, a phenol-formaldehyde bakelite-bonded plywood. In 1941 the Company was reorganized and the name was changed to Globe Aircraft Corporation.

The first product of the re-constituted company was a small two-seat low-wing cabin monoplane known as the Swift. The Swift Model GC-1 was awarded an Approved Type Certificate in the Spring of 1942 but it never went into production owing to the restriction of materials. A description of the Model GC-1 appeared in the 1942 edition of this Annual.

In 1942 a licence agreement was concluded between the Beech Aircraft Corpn. and the Globe Aircraft Corpn. under which the latter undertook to manufacture 600 Beechcraft AT-10 twin-engined training monoplanes for the U.S. Army Air Forces. This contract was completed in 1944 and to replace it the company undertook sub-contract work for the Curtiss C-46 and other aircraft.

A new version of the Swift has now been produced and two models are in production:—the GC-1A with an 85 h.p. Continental four-cylinder horizontally-opposed engine, and the GC-1B with a 125 h.p. Continental six-cylinder engine. Constructionally the two aircraft are identical although the difference in power-unit results in a change in nose shape. The prototype GC-1A made its initial test flights in January, 1945.

A licence for the manufacture of the Globe Swift in Great Britian has been acquired by Helliwells, Ltd. of Walsall, Staffs. The British version will be known as the Helliwell Globe.

THE GLOBE SWIFT MODEL GC-1A.

Type.—Two-seat enclosed low-wing monoplane.

Wings.—Cantilever low-wing monoplane. Aerofoil section (root) NACA 23015; (tip) NACA 23009. All-metal two-spar structure in five main sections consisting of centre-section; two outer wings and detachable tips. Main spar, at 30% chord, of channel-type construction with metal angle cap-strips and metal web riveted together. Rear auxiliary spar similarly constructed except that cap strips and web are formed as integral unit. Inter-spar shear web-type ribs inboard and outboard of fuel tanks. Shear web-type nose ribs and two auxiliary shear beams between two ribs forming torque box in area of landing gear attachment points. Stressed metal skin. Wing root chord 6 ft. 3 in. (1.90 m.). Dihedral 6 degrees. Incidence 2 degrees; gross wing area 131.63 sq. ft. (12.23 sq. m.). Built-in NACA wing-tip slots constructed as separate units and detachable from wings. All-metal Frise-type statically and dynamically-balanced ailerons with stressed metal skin. Aileron area (total) 9.3 sq. ft. (.86 sq. m.). All-metal slotted trailing-edge flaps between ailerons and fuselage. Hydraulic operation. Total flap area 11.59 sq. ft. (1.07 sq. m.).

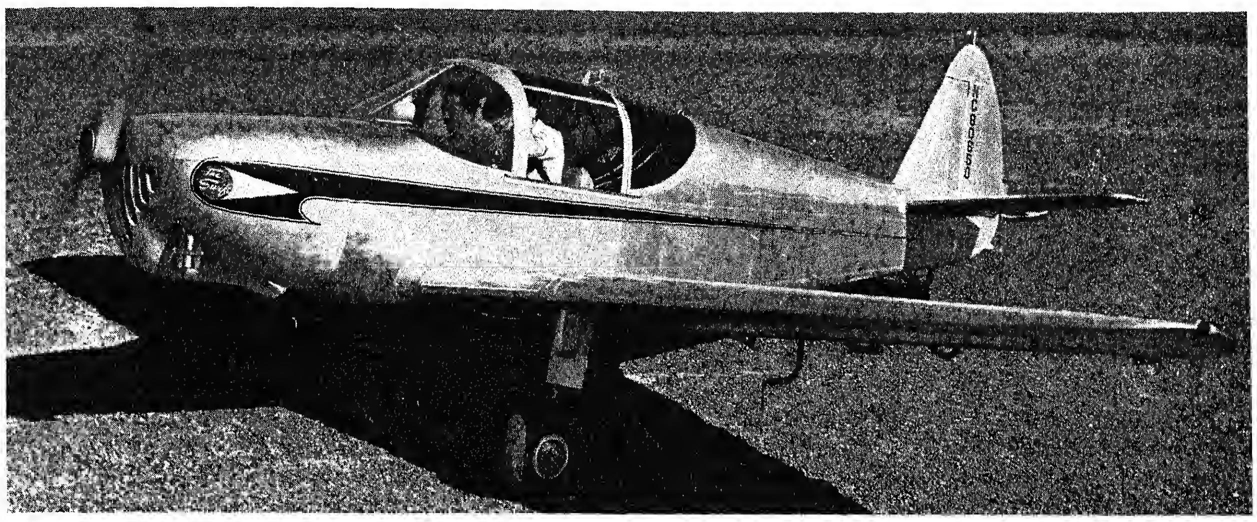
Fuselage.—Semi-monocoque metal structure consisting of front and rear portions. Four longerons, vertical frames and bulkheads and metal skin.

Tail Unit.—All-metal monoplane type. Cantilever fin and tailplane with stressed metal skin. Tailplane has 8 degrees dihedral. Fin offset 2 degrees to port. Balanced rudder and elevators have formed metal ribs and metal skin. Leading-edge ribs of blanked sheet with skin riveted to ribs and spar. Controllable trim-tab in port elevator; rudder trim adjustable on ground. Tailplane area 13.12 sq. ft. (1.30 sq. m.); fin area 3.62 sq. ft. (.33 sq. m.); elevator area (each) 7.12 sq. ft. (.66 sq. m.); elevator tab area 0.6 sq. ft. (.056 sq. m.); rudder area 5.53 sq. ft. (.51 sq. m.).

Landing Gear.—Retractable two-wheel type. Each main wheel, carried in half-fork on oleo-spring shock-absorber leg, retracts inwards into wing forward of main spar. Electro-hydraulic operation with emergency mechanical lowering gear. Track 9 ft.

The Globe Swift GC-1A Two-seat Cabin Monoplane (85 h.p. Continental C85-12 engine).

GLOBE—*continued.*



The Globe Swift Model GC-1B Two-seat Cabin Monoplane (125 h.p. Continental C125 engine).

9 in. (2.97 m.). Hydraulic brakes operated by toe pedals. Non-retractable tail-wheel. Twin float or ski gear as alternative.

Power Plant.—One 85 h.p. Continental C85-12 four-cylinder horizontally-opposed air-cooled engine on rubber-faced welded steel tube mounting and driving a two-blade fixed-pitch airscrew, or Beech-Roby or Aeromatic variable-pitch airscrew on *de Luxe* version. Four-piece cowling. Total fuel capacity 30 U.S. gallons (113 litres) in two wing tanks.

Accommodation.—Enclosed cockpit seating two side-by-side with dual controls. Side panels slide upwards for access. Baggage allowance 100 lb. (45 kg.).

Dimensions.—Span 29 ft. 4 in. (8.94 m.), Length 19 ft. 7 in. (5.96 m.), Height 6 ft. 2 in. (1.88 m.).

Weights and Loadings.—Weight empty 940 lbs. (426 kg.), Weight loaded 1,570 lbs. (712 kg.), Wing loading (fully loaded) 11.93 lbs./sq. ft. (58.25 kg./sq. m.), Power loading (fully loaded) 18.47 lbs./h.p. (8.37 kg./h.p.).

Performance. (At loaded weight)—Maximum speed 135 m.p.h. (217 km.h.) at sea level, Cruising speed 125 m.p.h. (201 km.h.) at sea level, Landing speed (without flaps) 47 m.p.h. (76 km.h.), Landing speed (with flaps) 42 m.p.h. (68 km.h.), Rate of climb at sea level 700 ft./min. (213 m./min.), Service ceiling 14,500 ft. (4,420 m.), Range at cruising speed 700 miles (1,126 km.), Take-off distance 662 ft. (202 m.), Landing distance 200 ft. (61 m.).

THE GLOBE SWIFT MODEL GC-1B.

The Model GC-1B Swift is powered by the 125 h.p. Continental C125 six-cylinder horizontally-opposed air-cooled engine, driving an Aeromatic constant-speed airscrew. Except for the power-plant change and difference in shape of the nose, the aircraft is similar to the Model GC-1A.

Weights and Loadings.—Weight empty 1,110 lbs. (503 kg.), Disposable load 600 lbs. (272 kg.), Weight loaded 1,710 lbs. (775 kg.), Wing loading 13 lbs./sq. ft. (63.5 kg./sq. m.), Power loading 13.69 lbs./h.p. (6.2 kg./h.p.).

Performance.—Maximum speed 150 m.p.h. (241 km.h.) at sea level, Cruising speed 140 m.p.h. (225 km.h.) at sea level, Landing speed (with flaps) 48 m.p.h. (77 km.h.), Rate of climb at sea level 1,000 ft./min. (305 m./min.), Service ceiling 16,000 ft. (4,865 m.), Range at cruising speed 512 miles (824 km.), Take-off distance 228 yds. (208 m.), Landing distance 127 yds. (116 m.).

GOODYEAR.

THE GOODYEAR AIRCRAFT CORPORATION.

Head Office and Works: Akron 15, Ohio.

President: P. W. Litchfield.

Vice-President and General Manager: Harry E. Blythe.

Vice-President in charge of Production: Russell DeYoung.

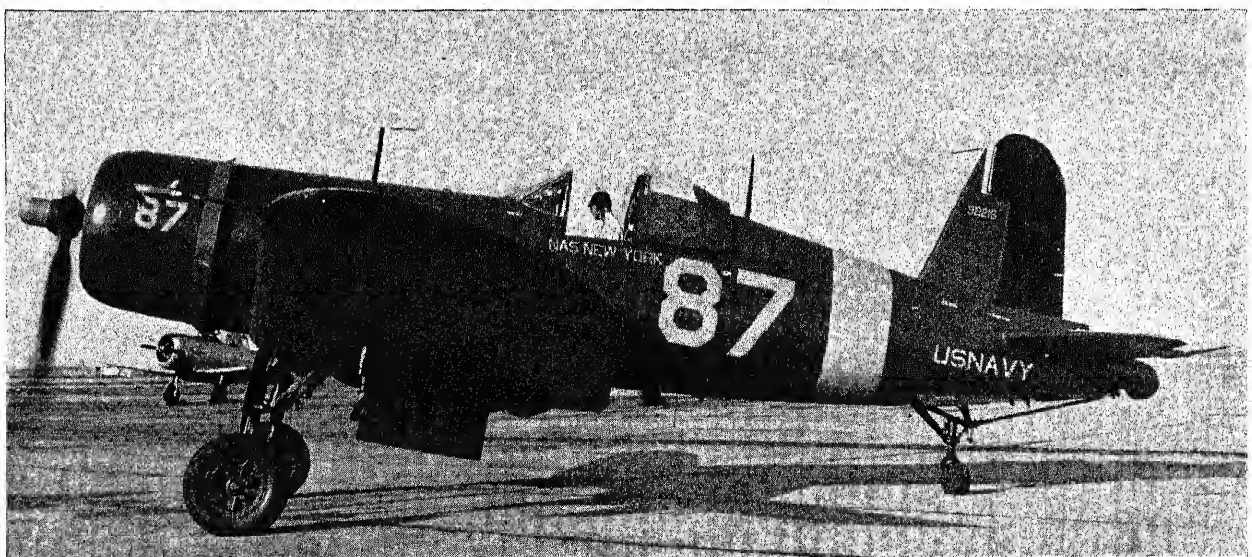
Vice-President in charge of Engineering: Dr. Karl Arnstein.

Secretary: H. L. Hyde.

Treasurer: Zimri C. Oseland.

The Goodyear Aircraft Corpn. was formed on December 5, 1939, to take over from the parent Goodyear organization its principal manufacturing operations in the field of aeronautics, with the exception of tyres, inner tubes, bullet-proof fuel tanks and other rubber accessories. This also included the activities of the former Goodyear-Zeppelin Corpn., then mainly devoted to lighter-than-air craft.

During the war the Corporation was engaged in the manufacture of aircraft, aircraft components and sub-assemblies. In the lighter-than-air field Goodyear fulfilled for the U.S. Navy a programme of upwards of 200 airships ranging from the L-type trainers of 125,000 cub. ft. (3,538 cub. m.) capacity to the K and M patrol ships having a helium gas capacity of 425,000 cub. ft. (12,028 cub. m.) and 725,000 cub. ft. (20,524 cub. m.) respectively. After the completion of the airship programme in April 1944, the activities of the Corporation were devoted solely to the production of aircraft, parts and sub-assemblies as well as the manufacture of Goodyear wheels, brakes and other specialised components.



A Goodyear-built FG-1D Corsair Night Fighter (Pratt & Whitney R-2800-BW engine).—(*Edgar Deigen*).

GOODYEAR—*continued*.

The Goodyear Aircraft Corporation built the Corsair to Chance Vought design under the designations FG-1, FG-3 and FG-4, the first Goodyear FG-1 Corsair being delivered to the U.S. Navy in April, 1943. A Goodyear development of the Corsair, known as the F2G-1, was also developed and put into production but it was too late to participate in the War.

The Goodyear company also produced an experimental all-metal flying-boat amphibian known as the GA-1. It was a high-wing monoplane powered by a six-cylinder horizontally-opposed air-cooled engine mounted above the fuselage and driving a pusher propeller. Only one aircraft of this type was built, and it was used as a flying laboratory. The maximum speed was over 100 m.p.h. (161 km.h.) and the range 350 miles (563 km.).

THE GOODYEAR F2G-1 CORSAIR.

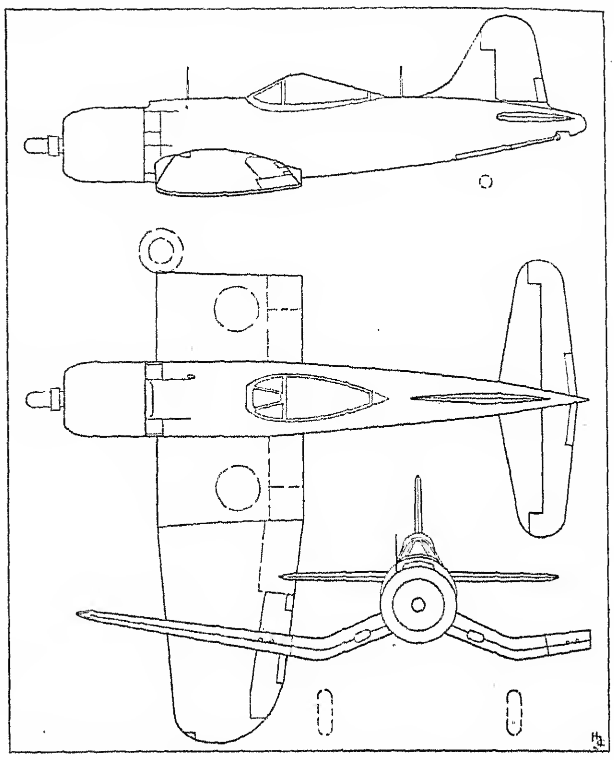
The F2G-1 was a development of the FG-1, the Goodyear production version of the Chance Vought F4U-1 Corsair. It was generally similar to the FG-1 except for a redesigned fuselage with a blister-type cockpit canopy and a new power-plant section.

The F2G-1 was fitted with a Pratt & Whitney R-4360-4 28-cylinder four-row radial air-cooled engine, which has a normal take-off rating of 3,000 h.p. and an emergency rating with water-injection of 3,650 h.p. This engine drove a Hamilton Standard Hydromatic four-blade constant-speed airscrew.

Armament consisted of six wing-mounted .5 in. (12.7 m/m.) machine-guns and eight rocket projectiles could be carried under the wings. Two 1,000 lb. (454 kg.) bombs, auxiliary drop tanks or additional rockets could be carried under the fuselage.

Dimensions.—Span 41 ft. (12.5 m.), Length 33 ft. 9 in. (10.3 m.), Height 16 ft. 1 in. (4.9 m.).

Performance.—Maximum speed (without water injection) 428 m.p.h. (985 km.h.) at 16,500 ft. (5,030 m.), Maximum speed (with water injection) 450 m.p.h. (720 km.h.) at 16,500 ft. (5,030 m.), Maximum rate of climb 7,000 ft./min. (2,135 m./min.), Range (with auxiliary drop tanks) 2,500 miles (4,000 km.).



The Goodyear F2G-1 Corsair.

GRUMMAN.

THE GRUMMAN AIRCRAFT ENGINEERING CORPORATION.

Head Office and Works : Bethpage, Long Island, N.Y.

Incorporated : December 6, 1929.
President : Leroy R. Grumman.
Executive Vice-President : Leon A. Swirbul.
Vice-President and Chief Engineer : William T. Schwendler.
Vice-President : E. Clinton Towl.
Secretary : Joseph A. Stamm.
Treasurer : Edmund W. Poor.

Since the beginning of 1942 the manufacturing floor space of the Grumman Company has been more than trebled and production was solely devoted to aircraft construction and experimental development for the U.S. Navy.

Between December 7, 1941, and August 14, 1945, the Grumman company delivered 17,135 aircraft, mainly to the U.S. Navy. 1945 production to VJ-Day totalled 4,067 aircraft, the peak month of that year being March when 658 aircraft were delivered, 605 of them Hellcats.

After VJ-Day the Hellcat and Goose were discontinued, but the Bearcat, Tigercat and Widgeon are still in production, the last-mentioned as a civil type. The Widgeon was in production for the U.S. Navy and Coast Guard until early in 1945, but thereafter it was built under a commercial licence for delivery to high-priority agencies or companies. When priorities were lifted after the war deliveries continued on a normal commercial basis, the Widgeon being thus one of the first post-war personal aircraft to reach private owners. This version, the G-44A, incorporates a number of improvements which were introduced in 1945.

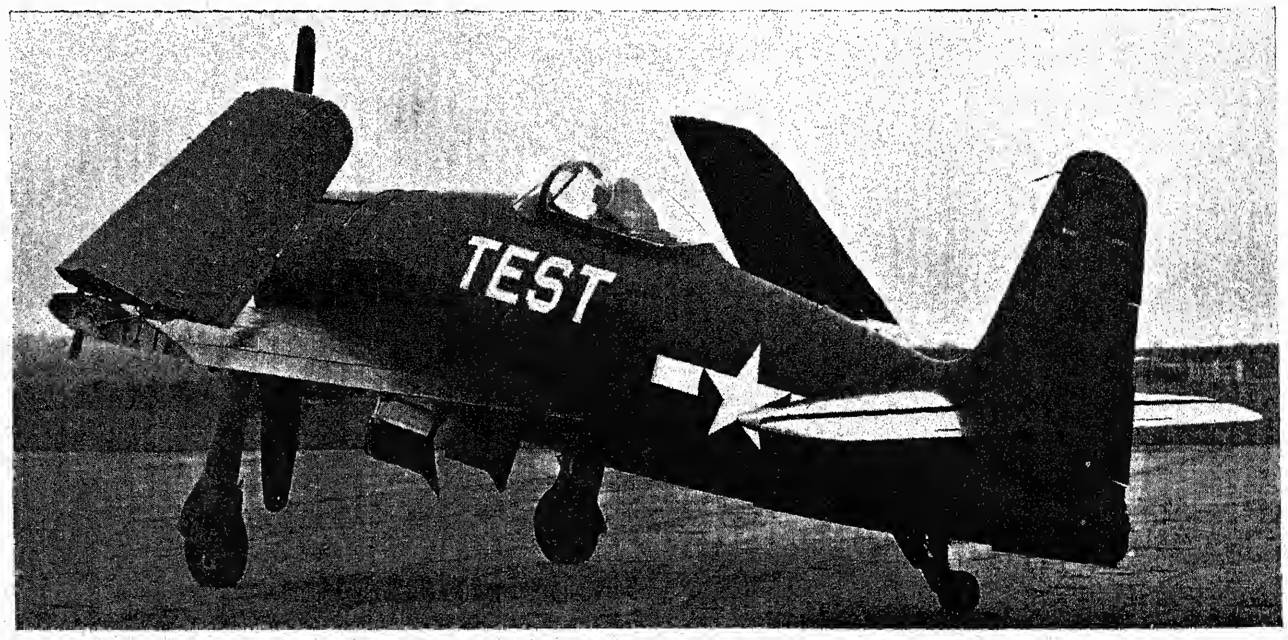
Aircraft under development include the Mallard amphibian, an enlarged version of the Goose; a two-seat light personal aircraft; a light three-seat pusher amphibian with tricycle landing-gear; and the XJR2F-1 General Utility amphibian with accommodation for a crew of three and sixteen passengers for the U.S. Navy.

THE GRUMMAN BEARCAT.

U.S. Navy designation : F8F.

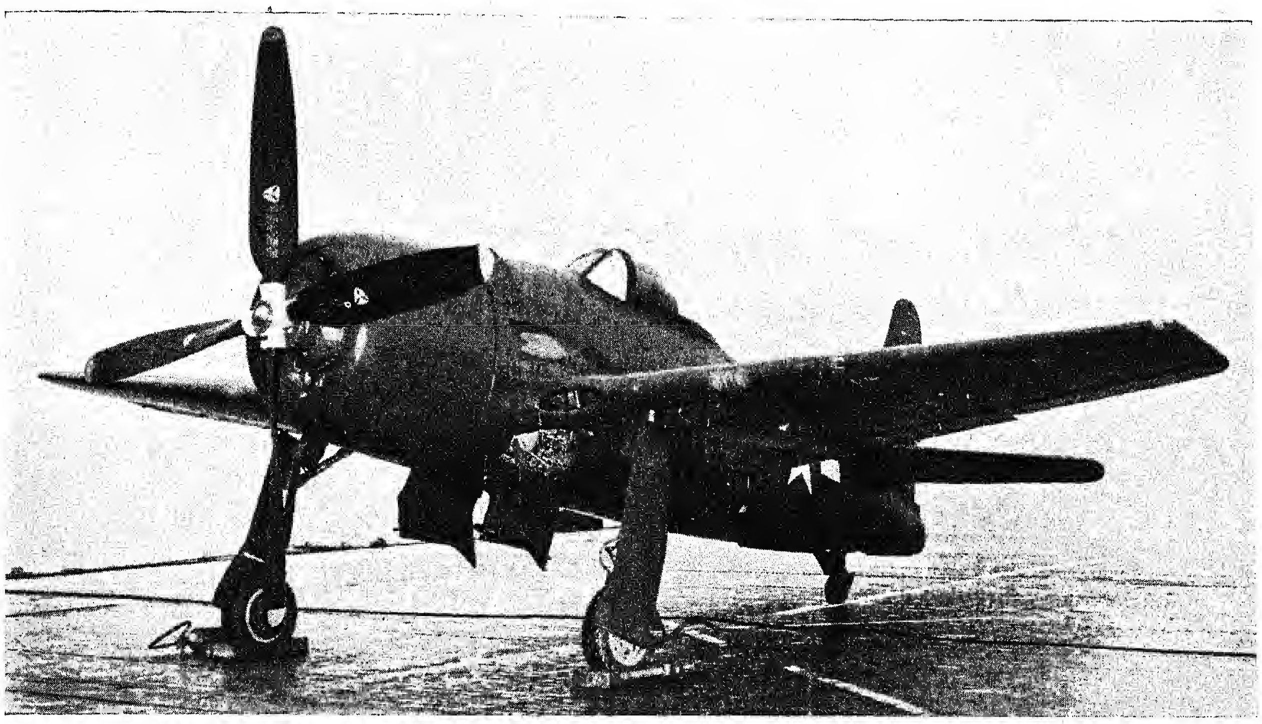
The Bearcat is a single-seat Fighter bearing the characteristic lines of the earlier Grumman fighters from which it was developed. The standard version is the F8F-1 with four .5 in. (12.7 m/m.) machine-guns, which on the F8F-1C are replaced by four 20 m/m. cannon.

The designation F3M was allotted to the Bearcat to be built by the Eastern Aircraft Division of the General Motors Corporation, but the contracts were cancelled before any aircraft were delivered.



The Grumman F8F-1 Bearcat Single-seat Fighter (Pratt & Whitney R-2000-34W engine) with wings folded.

***GRUMMAN**—continued.*



A Grumman F8F-1 Bearcat Single-seat Fighter on the deck of the U.S. Escort Carrier "Charger".

Type.—Single-seat Carrier Fighter.

Wings.—Cantilever mid-wing monoplane. All-metal structure in three sections with flush-riveted metal skin. Dihedral from roots. "Safety wing-tips" automatically jettisoned in flight in cases of overload to prevent failure of main wing structure. Sections break away at about 3 ft. (0.91 m.) from the tips, including half the ailerons. Outer wing sections fold upwards for stowage. Fabric-covered metal ailerons and hydraulically-operated slotted flaps. Wing area 244 sq. ft. (22.66 sq. m.).

Fuselage.—All-metal monocoque structure with integral fin.

Tail Unit.—Cantilever monoplane type. All-metal structure with metal-covered fixed surfaces and fabric-covered rudder and elevators. Fin built integral with fuselage. Trim-tabs in rudder and elevators.

Landing Gear.—Retractable two-wheel type. Each main wheel, carried in half-fork on single shock-absorber leg, retracts inwards into wing and fuselage and is fully enclosed by fairing plates attached to leg and by hinged doors under fuselage. Hydraulic operation. Tail-wheel retracts rearwards into fuselage. Deck arrester hook.

Power Plant.—One Pratt & Whitney R-2800-34W eighteen-cylinder two-row radial air-cooled engine developing 2,100 h.p. for take-off, and combat power of 2,800 h.p. with water injection. Aeroprop four-blade constant-speed airscrew 12 ft. 7 in. (3.82 m.) diameter. Internal bullet-proof fuel tanks with total capacity of 185 U.S. gallons (700 litres). Two long-range drop-tanks each of 150 U.S. gallons (568 litres) capacity may be carried under wings.

Accommodation.—Pilot's enclosed cockpit with flat bullet-proof windshield and sliding bubble canopy. Armour plating behind pilot.

Armament.—Four .5 in. (12.7 m/m.) machine-guns (F8F-1) or four 20 m/m. cannon (F8F-1C) mounted two in each wing outside airscrew disc. Provision for bombs up to total of 2,000 lbs. (907 kg.) or four 5 in. (12.7 c/m.) rocket projectiles under wings.

Dimensions.—Span 35 ft. 6 in. (10.82 m.), Width folded 23 ft. 9½ in. (7.25 m.), Length 28 ft. 3 in. (8.61 m.), Height 13 ft. 10 in. (4.22 m.).

Weights and Loadings.—Weight loaded 9,300 lbs. (4,222 kg.), Wing loading 38.2 lbs./sq. ft. (186.4 kg./sq. m.), Power loading at take-off 3.3 lbs./h.p. (1.5 kg./h.p.).

Performance.—Maximum speed over 455 m.p.h. (732 km.h.) at rated height, Speed at sea level 425 m.p.h. (684 km.h.), Rate of climb (with water injection) 6,500 ft./min. (1,980 m./min.), Normal rate of climb 5,000 ft./min. (1,525 m./min.), Service ceiling 42,300 ft. (12,895 m.), Maximum ferrying range 2,200 miles (3,740 km.).

THE GRUMMAN TIGERCAT.

U.S. Naval designation : F7F.

The Tigercat is a twin-engined single or two-seat Fleet Fighter which has appeared in the following versions :—

XF7F-1. Two Pratt & Whitney R-2800-22 engines. Prototype aircraft.

F7F-1N. First production version. Single-seat Night Fighter with nose armament.

F7F-2N. Two-seat Night Fighter version with rear seat added for radar-operator. Nose armament.

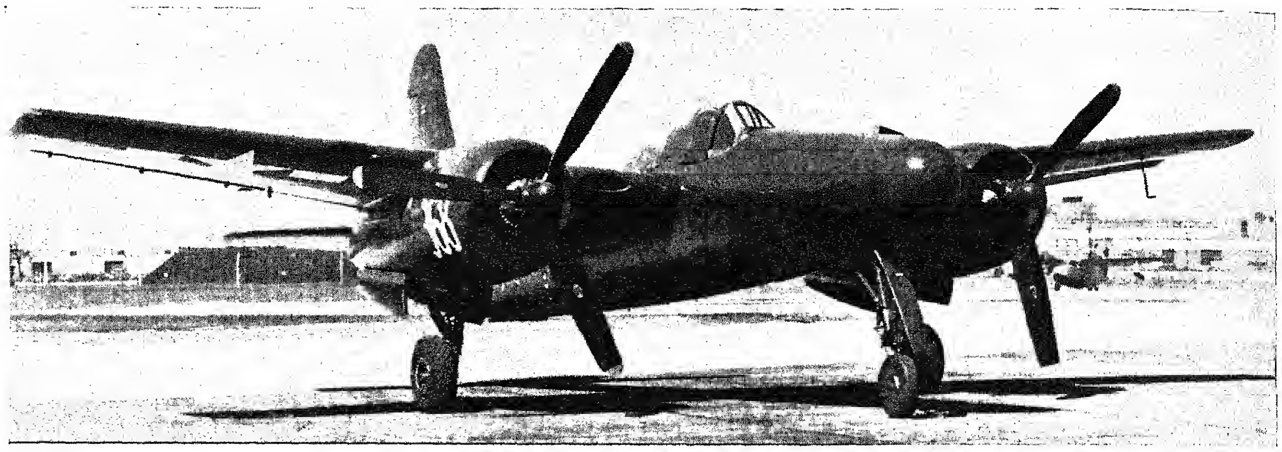
F7F-3. Single-seat Day Fighter. Extra fuel tank carried in place of radar-operator. Nose armament.

F7F-3N. Two-seat Night Fighter with radar-operator in place of auxiliary fuel tank. Radar in bulbous nose. Redesigned fin and rudder of greater height and area. Armament in wing roots.

F7F-4N. Development of the F7F-3N with radar enclosed in a streamlined nose.

The Grumman F7F-1N Single-seat Night Fighter (two Pratt & Whitney R-2800-22 engines).

GRUMMAN—*continued.*



The Grumman F7F-3N Tigercat Two-seat Night Fighter (two Pratt & Whitney R-2800-22W engines) with radar in a bulbous nose.

Initially the Tigercat was used by land-based Marine fighter squadrons. In spite of its size, speed and tricycle landing-gear the Tigercat has operated successfully from aircraft-carriers of the *Essex* class, although it was primarily designed for service in the 45,000 ton carriers of the *Midway* class.

Type.—Twin-engined Single or Two-seat Day or Night Fighter.

Wings.—Cantilever shoulder-wing monoplane. All-metal structure with straight leading-edge and swept-forward trailing-edge. Constant dihedral from roots. Flush-riveted aluminium-alloy stressed skin. All-metal ailerons with trim-tab in each. Slotted trailing-edge flaps in four sections between ailerons and fuselage. Outer wing sections fold upwards for stowage. Gross wing area 455 sq. ft. (42.26 sq. m.).

Fuselage.—Light alloy monocoque structure.

Tail Unit.—Cantilever monoplane type of all-metal construction. Trim-tab in rudder and elevators. F7F-3N and 4N have fin and rudder of increased height.

Landing Gear.—Retractable tricycle type. Each main wheel, on outside of outward-inclined shock-absorber leg, retracts backwards into engine nacelle and is enclosed by twin doors. Nose-wheel, in half-fork on shock-absorber leg, retracts backwards into fuselage and is enclosed by fairing plate attached to front of leg and by twin doors under fuselage. Retractable deck arrester hook under fuselage.

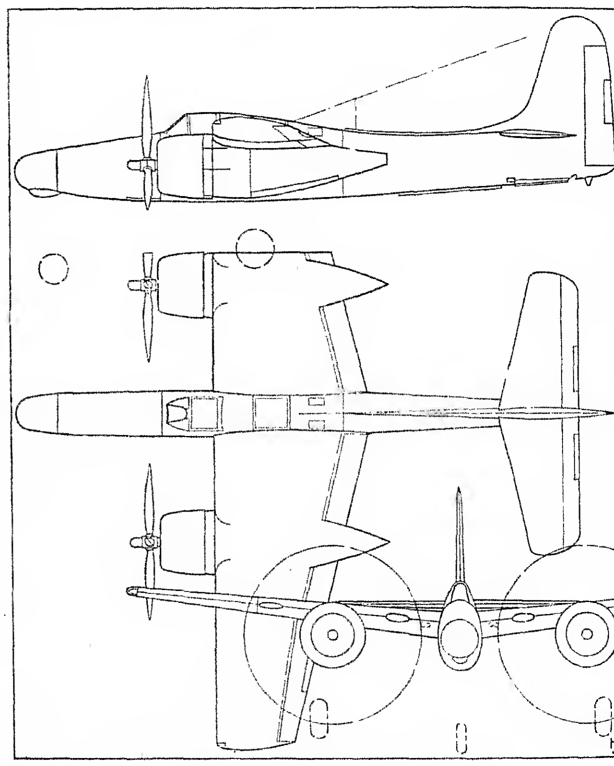
Power Plant.—Two Pratt & Whitney R-2800-22W eighteen-cylinder two-row radial air-cooled engines, each with a maximum rating of 2,100 h.p. (2,800 h.p. with water injection). Hamilton-Standard Hydromatic three-blade constant-speed airscrews, 13 ft. 9 in (4.19 m.) diameter. Main fuel tanks in wings. Provision for 150 U.S. gallon (568 litre) long-range drop-tank under fuselage.

Accommodation.—Pilot's cockpit in front of leading-edge of wing. Bullet-proof windscreen and body armour. Rear cockpit provided in Night Fighter versions for radar-operator. Radar carried in bulbous nose.

Armament.—Four 20 m/m. cannon mounted in nose on Day Fighter versions and in wing-roots in F7F-3N Night Fighter version. Racks for zero-length R.P. under outer wings. Provision for carriage of up to 4,000 lbs. (1,818 kg.) of bombs or two 22-in. (56 c/m.) torpedoes under inner wings.

Dimensions.—Span 51 ft. 6 in. (15.7 m.), Span (folded) 31 ft. 2½ in. (9.5 m.), Length (F7F-1 and -2) 45 ft. 4 in. (13.8 m.), Height 15 ft. 2 in. (4.6 m.).

Weights and Loadings.—Weight empty 16,200 lbs. (7,355 kg.), Normal loaded weight 21,620 lbs. (9,815 kg.), Wing loading 47.5 lbs./sq. ft. (231.8 kg./sq. m.), Power loading (take-off) 3.9 lbs./h.p. (1.7 kg./h.p.).

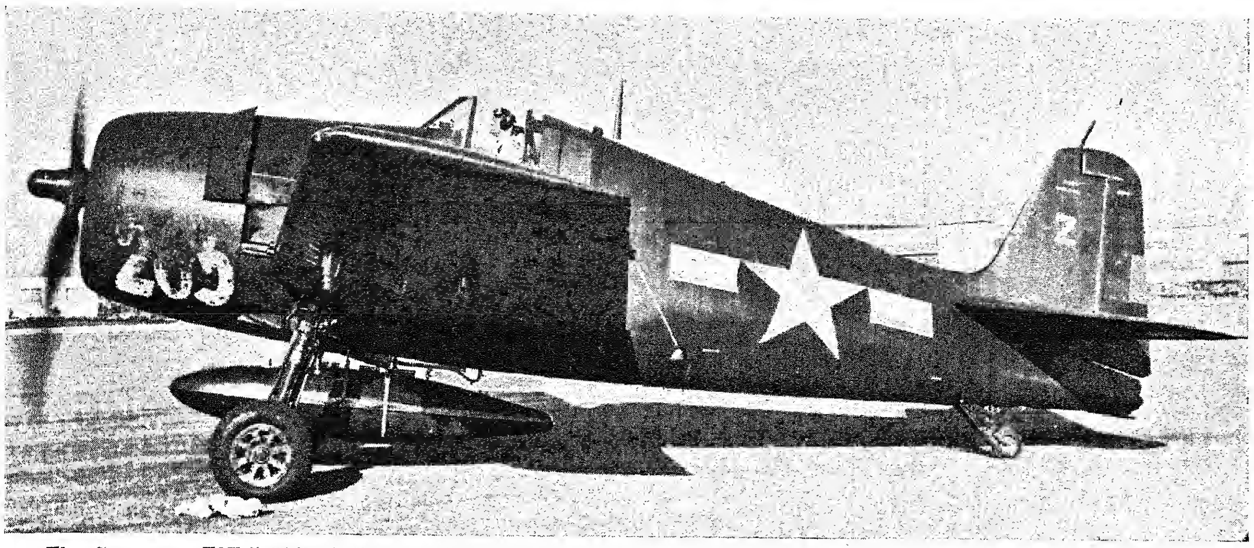


The Grumman F7F-3N Tigercat.

Performance.—Maximum level speed 427 m.p.h. (687 km.h.) at 19,200 ft. (5,852 m.), Stalling speed 89.0 m.p.h. (143.3 km.h.), Initial rate of climb 4,260 ft./min. (1,300 m./min.), Climb to 10,000 ft. (3,050 m.) 2.6 min., Climb to 20,000 ft. (6,100 m.) 6.2 min., Service ceiling 36,000 ft. (10,980 m.), Normal range 1,015 miles (1,623 km.).

The Grumman F7F-4N Night Fighter with re-designed radar nose.—(*Martin & Kelman*).

GRUMMAN—*continued.*



The Grumman F6F-5 Hellcat Single-seat Fighter (2,000 h.p. Pratt & Whitney R-2800-10W engine).—(*Peter Bowers*).

THE GRUMMAN HELLCAT.

U.S. Naval designation : F6F.

The Hellcat was designed in the Spring of 1942. The prototype XF6F-1 first flew in August and it was in large-scale production as the F6F-3 by the end of the same year. The Hellcat was first reported in action with a U.S. Carrier Task Force in an attack on Marcus Island on September 1, 1943.

The F6F-5 differed from its predecessor by having a redesigned engine cowling, improved windshield, new ailerons, strengthened tail surfaces, additional armour behind the pilot and a waxed high-gloss skin finish. The F6F-5 could also carry two 1,000 lb. (454 kg.) bombs under the centre-section, drop tanks in place of bombs and was equipped to carry rocket projectile equipment and search radar (F6F-5E). Night Fighter (F6F-5N) and Photographic-Reconnaissance (F6F-5P) versions were also in service.

The F6F-5K is a long-range radio-controlled pilotless drone version of the Hellcat. The modification was undertaken by the Naval Aircraft Modification Unit at Johnsville, Pa. Several F6F-5K drones were used in the Bikini operations.

The F6F-5 was the last operational version of the Hellcat, which was finally withdrawn from production in November, 1945. The 10,000th Hellcat was delivered to the U.S. Navy in the previous March, the Hellcat being the only U.S. aircraft designed and built after Pearl Harbour to be produced in this quantity.

Type—Single-seat Fighter.

Wings.—Mid-wing cantilever monoplane. Centre-section is flat and of constant thickness but has same constant taper as outer wing sections. Outer sections have dihedral angle and are arranged to fold. All-metal structure with flush-riveted metal skin. Split-flaps between ailerons and fuselage. Gross wing area 344 sq. ft. (31 sq. m.).

Fuselage.—All-metal monocoque structure with integral fin.

Tail Unit.—Cantilever monoplane type. Fin built integral with the fuselage. All-metal structure.

Landing Gear.—Retractable type. Shock-absorber units hinged at extremities of centre-section and are raised backwards, the wheels being turned through 90° to lie flush in wells in underside of centre-section. Hydraulic retraction. Retractable tail-wheel and arrester-hook.

Power Plant.—One 2,000 h.p. Pratt & Whitney R-2800-10W eighteen-cylinder double-row radial air-cooled engine driving a Hamilton Standard Hydromatic three-blade constant-speed airscrew 13 ft. 1 in. (4 m.) diameter. Bullet-proof fuel tanks in wings. An auxiliary droppable belly-tank may be fitted.

Accommodation.—Enclosed cockpit over wing with sliding canopy. Bullet-proof windscreen and armour behind pilot.

Armament.—Six .5 in. (12.7 m/m.) machine-guns, three in each outer wing.

Dimensions.—Span 42 ft. 10 in. (13.0 m.), Span (folded) 16 ft. 2 in. (4.9 m.), Length 33 ft. 6⅝ in. (10.2 m.), Height 14 ft. 5 in. (4.4 m.).

Weights.—Weight empty 9,212 lbs. (4,182 kg.), Normal loaded weight 12,730 lbs. (5,780 kg.).

Performance.—Maximum level speed 371 m.p.h. (594 km.h.), Stalling speed 85.5 m.p.h. (136.8 km.h.), Initial rate of climb 3,410 ft./min. (1,040 m./min.), Climb to 15,000 ft. (4,575 m.) 4.3 min., Service ceiling 36,700 ft. (11,190 m.), Normal range 1,040 miles (1,665 km.).

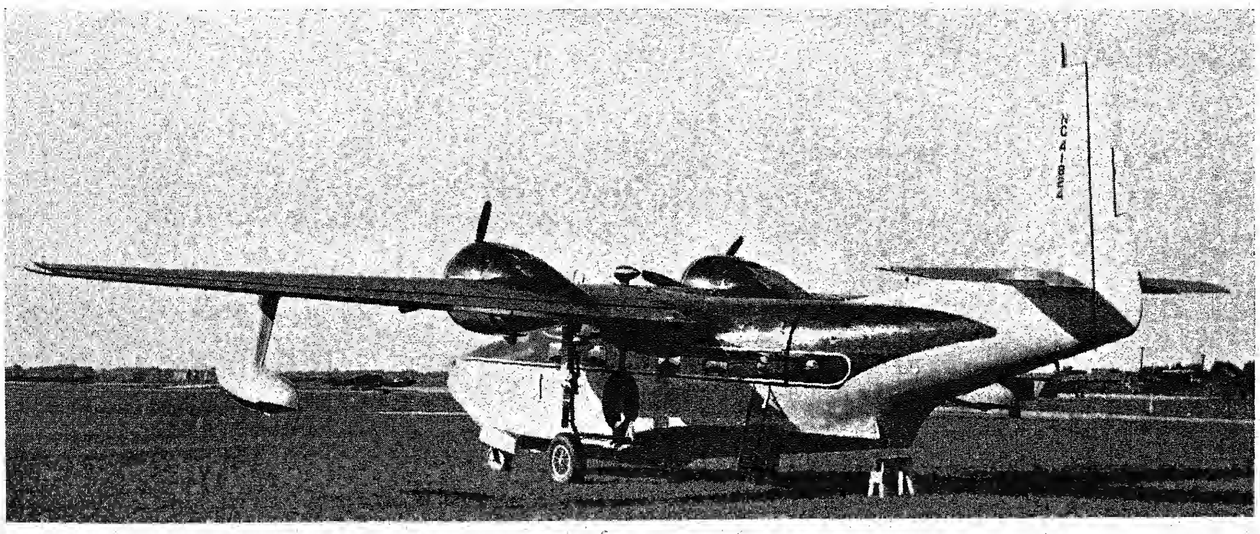
THE GRUMMAN MALLARD.

The Mallard eight/ten-seat amphibian, which is being developed for commercial purposes, is similar in lay-out to the Goose and Widgeon, but is larger and will be powered by two Pratt & Whitney Wasp H nine-cylinder radial engines driving Hamilton Standard Hydromatic three-blade constant-speed airscrews. It will have a retractable tricycle landing-gear with a track of 12 ft. 10 in. (3.9 m.) and fixed cantilever wing-tip floats.

Dimensions.—Span 66 ft. 8 in. (20.31 m.), Length 48 ft. 4 in. (14.72 m.), Height 19 ft. 4 in. (5.89 m.), Wing area 444 sq. ft. (41.24 sq. m.).

Weights and Loadings (Designed).—Useful load 3,858 lbs. (1,626 kg.), Weight loaded 12,000 lbs. (5,443 kg.), Wing loading 27 lbs./sq. ft. (131.7 kg./sq. m.), Power loading 10 lb./h.p. (4.5 kg./h.p.).

Performance (Estimated).—Maximum speed 215 m.p.h. (346 km.h.), Cruising speed 180 m.p.h. (290 km.h.), Initial rate of climb 1,400 ft./min. (427 m./min.), One-engine ceiling 10,500 ft. (3,200 m.), Cruising range with six passengers, crew of two and 240 lbs. (109 kg.) baggage 830 miles (1,336 km.), Cruising range with eight passengers, crew of two and 300 lbs. (136 kg.) baggage 570 miles (917 km.).



The Grumman Mallard Eight/Ten-seat Amphibian (two Pratt & Whitney Wasp engines).—(*Martin & Kelman*).

GRUMMAN—*continued.*

The Grumman G-44A Twin-engined Light Utility Amphibian (two 200 h.p. Ranger 6-440C-5 engines).

THE GRUMMAN G-44A WIDGEON.

The Grumman G-44A is the 1946 model of the Widgeon twin-engined light amphibian which is known in the U.S. Coast Guard as the J4F-1, in the U.S. Navy as the J4F-2 and in the U.S. Army as the OA-14.

The new version incorporates a number of improvements over the earlier aircraft. These include a deeper bow, step vents to aerate the after-body (giving improved water characteristics) and modified internal equipment.

TYPE.—Twin-engined light General-Utility Amphibian.

WINGS.—Cantilever high-wing monoplane. All-metal structure with large single box-section spar containing integral fuel tanks. Centre-section metal-covered, outer sections metal-covered to rear of spar with fabric covering aft to trailing-edge. Fabric-covered ailerons, with trim-tab in port aileron. Fabric-covered slotted trailing-edge flaps between ailerons and hull. Flaps lowered hydraulically and retracted by springs within operating cylinders. Wing area 245 sq. ft. (22.72 sq. m.).

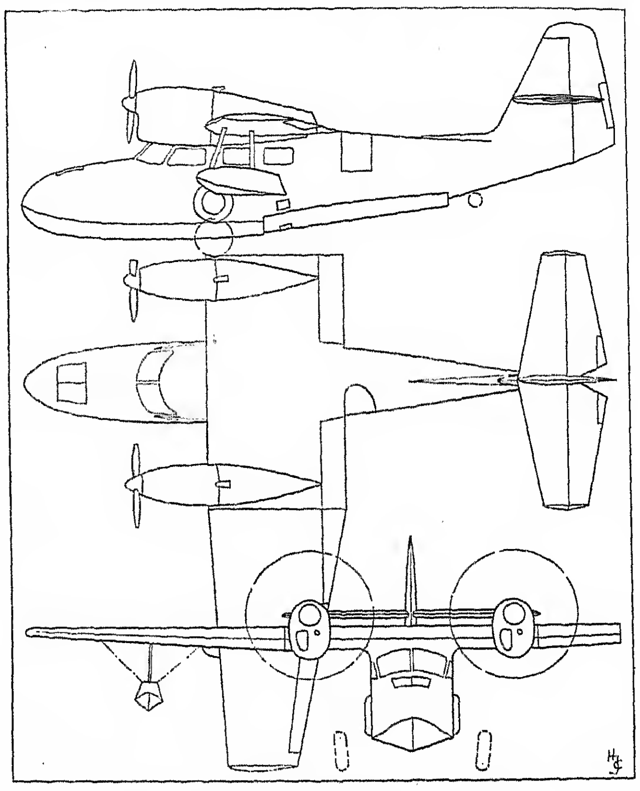
HULL.—Two-step all-metal structure divided into five watertight compartments. No bulkheads in cabin. Main step vented.

TAIL UNIT.—Cantilever monoplane type. Tailplane mounted half-way up the fin which is built integral with hull. All-metal construction with metal-covered fixed surfaces and fabric-covered rudder and elevators. Trim-tabs in movable surfaces.

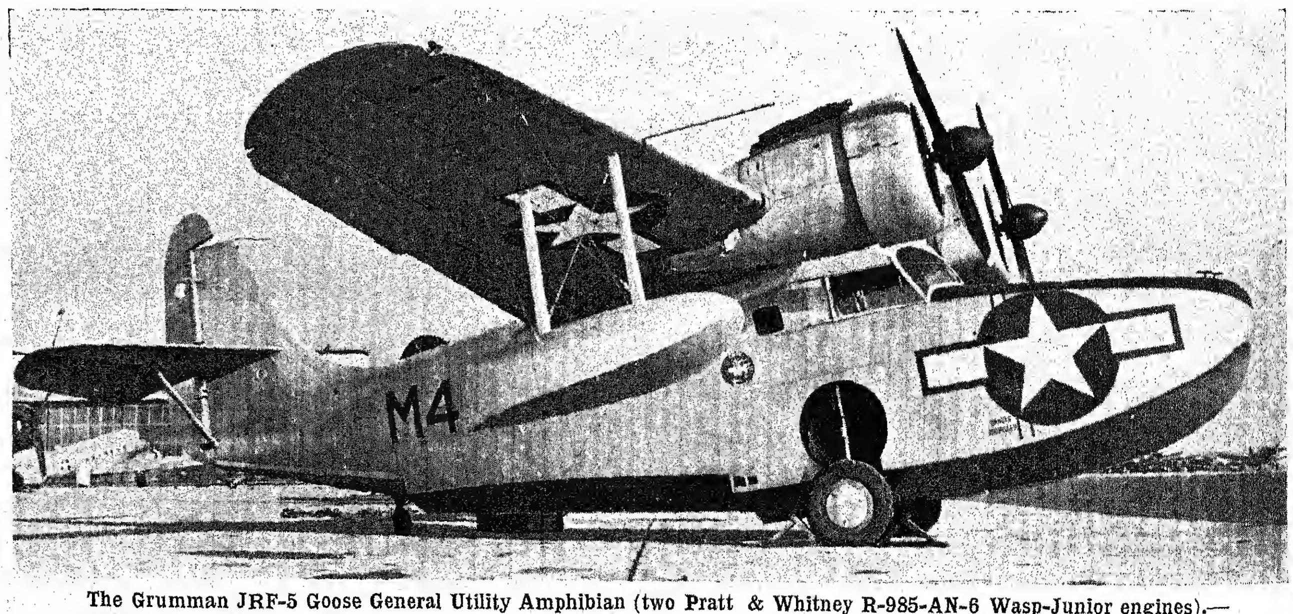
LANDING GEAR.—Retractable two-wheel type. Parallel links with hinged oleo strut, wheels fitting nearly flush with sides of hull. Retractable tail-wheel with directional lock. Windows in wheel pockets to check position of gear. Hydraulic operation with emergency hand-gear. Track 7 ft. 6 in. (2.29 m.).

POWER PLANT.—Two Ranger 6-440C-5 six-cylinder in-line inverted air-cooled engines each developing 200 h.p. at 2,450 r.p.m. and mounted on cantilever bearers projecting from main wing spar. Nacelles accessible from upper surface of wing. Sensenich No. 82RS72 two-blade fixed-pitch wooden airscrews with Curtiss No. 55518-10 two-blade fixed-pitch metal airscrews optional. Fuel capacity 108 U.S. gallons (409 litres). Each tank normally supplies its own engine but cross-flow valve permits both engines to operate from either tank. 87 Octane fuel. Oil tank of 3½ U.S. gallons (13 litres) capacity in each nacelle.

ACCOMMODATION.—Enclosed cabin seating four or five. Two seats side-by-side in front with throw-over dual controls, one optional seat immediately behind on port and two seats at rear. Main



The Grumman G-44A Widgeon Amphibian.



The Grumman JRF-5 Goose General Utility Amphibian (two Pratt & Whitney R-985-AN-6 Wasp-Junior engines).—(*Peter M. Bowers*).

GRUMMAN—*continued.*

entry door on port side behind wing. Four fixed windows in cabin, and sliding panels by front seats. Anchor compartment and hatch in nose.

Dimensions.—Span 40 ft. 0 in. (12.19 m.), Length 31 ft. 1 in. (9.47 m.), Height 11 ft. 5 in. (3.48 m.).

Weights and Loadings.—Weight empty 3,240 lbs. (1,470 kg.), Useful load 1,285 lbs. (583 kg.), Weight loaded 4,525 lbs. (2,053 kg.), Wing loading 18.4 lbs./sq. ft. (97.8 kg./sq. m.), Power loading at take-off 11.3 lbs./h.p. (5.1 kg./h.p.).

Performance.—Maximum speed 160 m.p.h. (257 km.h.), Cruising speed at 62½% power 130 m.p.h. (209 km.h.), Landing speed 50 m.p.h. (80 km.h.), Climb at sea level 1,000 ft./min. (305 m./min.), Service ceiling 15,000 ft. (4,570 m.), Range at cruising speed 715 miles (1,150 km.), Take-off run at sea level 298 yds. (272 m.), Take-off from water 25 seconds, Fuel consumption at cruising speed 20 U.S. gallons (76 litres) per hour.

THE GRUMMAN GOOSE.

U.S. Navy designation : JRF.
U.S. Army Air Forces designation : OA-9.

The Goose is a military adaptation of the pre-war commercial Model G-21A. It was first put into service in the U.S. Navy as the JRF-1 and the U.S. Coast Guard as the JRF-2 in 1939-40. Further series included the JRF-1A, fitted for target-towing and photography; the JRF-3 (Coast Guard) fitted with anti-icing equipment and auto-pilot for use in Northern waters; the JRF-4, a development of the JRF-1; the JRF-5 (OA-9), similar to the JRF-4 but fitted for photography; and the JRF-6B, similar to JRF-1 but equipped as a navigational trainer.

Production of the JRF ceased in September, 1945, but the type is still in service in the U.S. Navy and Coast Guard as a general utility amphibian.

Type.—Twin-engined General Utility amphibian.

Wings.—High-wing cantilever monoplane. Centre-section and detachable tapering outer sections. Metal structure consisting of a tapering box-spar with its rear face at 36% of the chord from the leading-edge. Elementary rib structure and metal skin plating complete the leading-edge. The rear 66% of both centre-section and outer sections is fabric-covered over duralumin ribs cantilevered from the rear face of the spar. Vacuum-operated split trailing-edge flaps from hull to ailerons. Wing area 375 sq. ft. (34.8 sq. m.).

Hull.—Two-step all-metal hull. Rectangular section forward, but aft of second step the section is oval and fairs into fin. Six water-tight bulkheads.

Tail Unit.—Monoplane type. Cantilever fin built integral with hull. Tail-plane strut-braced to hull. All-metal framework with sheet covering. Movable surfaces have duralumin frames and are covered with fabric. Trimming-tabs in elevators and rudder.

Landing Gear.—Grumman type with parallelogram linkage mechanically retracted by worm and gear. Wheels withdrawn into recesses in sides of hull. Retractable tail-wheel, with centring lock.

Power Plant.—Two Pratt & Whitney Wasp-Junior R-985-AN6 radial air-cooled engines, each rated at 400 h.p. at 5,000 ft (1,525 m.). Steel-tube mountings bolted to lower flanges of box-spar and to upper edges of duralumin anchors built into upper surface of wing-spar at extremities of centre-section. Hamilton-Standard controllable-pitch airscrews. Fuel tanks integral with box-spars. Total fuel capacity 220 U.S. gallons (833 litres). Oil tanks in engine-mountings. Total oil capacity 15 U.S. gallons (57 litres).

Accommodation.—In the nose is a mooring compartment with stowage for anchor and marine gear, vacuum storage tank, radio units and excess baggage. Pilot's compartment seats two side-by-side, with dual controls and wide aisle between. Thereafter follows cabin, to which access is gained through a wide hatch at the trailing-edge of the wing on the port side. Emergency hatch on starboard side, opposite main hatch. Equipment varies according to function of aircraft. JRF-5 and earlier models still in service are for general utility work, which includes personnel transport, ambulance duties, photographic work, target towing, etc. JRF-6B is a navigational trainer and general utility amphibian.

Dimensions.—Span 49 ft. (14.95 m.), Length 38 ft. 4 in. (11.7 m.), Height (on wheels) 15 ft. (4.57 m.).

Weights and Loadings.—Weight empty 5,425 lbs. (2,461 kg.), Disposable load (standard equipment) 2,575 lbs. (1,168 kg.), Weight loaded 8,000 lbs. (3,629 kg.), Wing loading 21.3 lbs./sq. ft. (103.9 kg./sq. m.), Power loading 8.9 lbs./h.p. (4 kg./h.p.).

Performance.—Maximum speed at 5,000 ft. (1,525 m.) 201 m.p.h. (323 km.h.), Cruising speed at 5,000 ft. (1,525 m.) 191 m.p.h. (307 km.h.), Rate of climb at sea level 1,100 ft./min. (335 m./min.), Service ceiling 21,000 ft. (6,405 m.), Maximum range 640 miles (1,287 km.).

HIGGINS.

HIGGINS, INC.

Head Office : New Orleans 19, Louisiana.
President : Andrew J. Higgins.
Vice-President : Frank O. Higgins.
Director of Engineering : George A. Allward.

Higgins, Inc., a subsidiary of Higgins Industries, Inc., which in turn is owned by Mr. Andrew Higgins who earned world-wide fame as a builder of ships, was formed in 1942 to undertake the construction of transport aircraft for the U.S. Army Air Forces.

Towards the end of 1942, the company was awarded a contract to build 500 Curtiss C-76 Caravan all-wood twin-engined transports for the U.S. Army Air Forces, but in September, 1943, this contract was cancelled and replaced by another to build the same number of Curtiss C-46 Commando twin- engined all-metal transports.

In August, 1944, the C-46 contract was cancelled and thereafter the company undertook the manufacture of C-46 outer wings under sub-contract to the Curtiss Wright Corporation.

In 1943 Higgins Industries, Inc. began development of a helicopter under the direction of Mr. Enea Bossi in part of the Isaac Delgado Trade School, New Orleans, which was taken over by the Higgins organization for the purpose. This work was quite independent of the activities of Higgins, Inc.

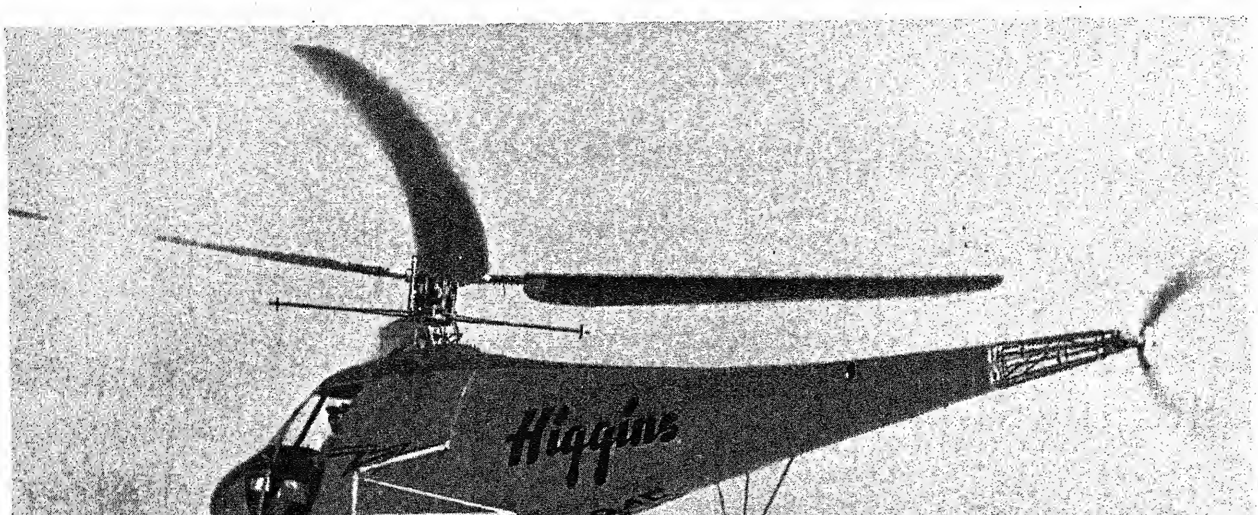
When all Army contracts were cancelled at the end of the war Higgins Industries, Inc., suspended all its aircraft activities. The helicopter described and illustrated herewith is an experimental craft but it has completed many hours of flight testing.

Higgins, Inc., which has a twin-engined four-passenger helicopter partially built, hopes to resume activities and complete this second helicopter in the near future.

THE HIGGINS EXPERIMENTAL HELICOPTER.

The Higgins Helicopter is a two-seat single-rotor craft with a small vertical torque rotor at the rear end of the fuselage.

The power-plant consists of a 180 h.p. pressure-cooled Warner seven-cylinder radial mounted flat on the floor of the fuselage behind the pilot's cabin and driving the four-blade rotor through a clutch transmission and free-wheeling unit.



The Higgins Experimental Two-seat Helicopter (180 h.p. Warner engine with pressure cooling).

HIGGINS—*continued.*

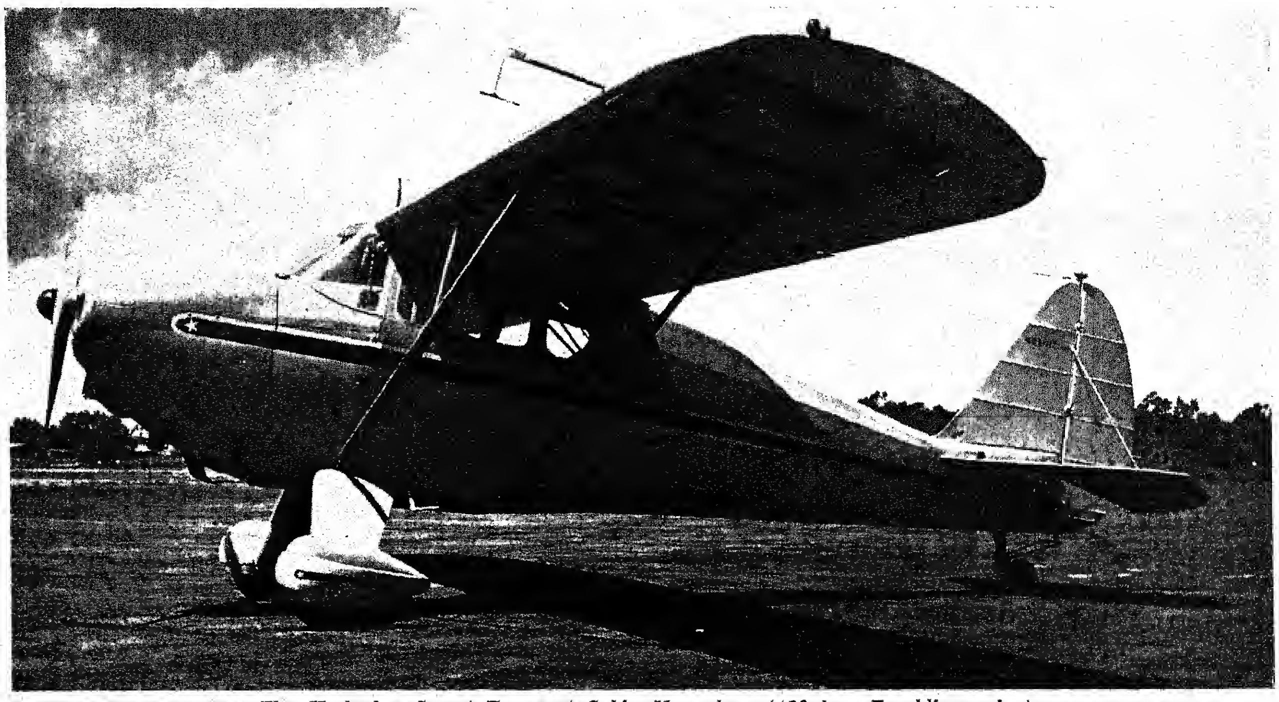
The four-blade rotor tilts as a unit and the direction of tilt determines the direction of flight. The pitch of the four blades is changed in unison, as opposed to the cyclical pitch-change in which the pitch is different for each blade depending on its position in the disc area.

For longitudinal or lateral control a normal control column is used, fore-and-aft or lateral movement rocking a swash-plate in the rotor head which causes the blades to tilt as a unit, the fuselage remaining on an even keel regardless of the pitch of the blades or the positions of their axes with respect to the axis of the fuselage. Pitch control for ascent or descent is by a separate lever operating a shaft within the main drive shaft which, in sliding up or down, changes the rotor pitch uniformly through a series of levers within the head acting on the rotor spars. Blade pitch may be varied from 5 to 15 degrees. At a predetermined pitch control position hovering is achieved. In the event of engine failure a free-wheeling unit permits auto-rotation.

Directional control, by the usual foot pedals, is through the power-driven vertical tail rotor which consists of a two-blade variable-pitch airscrew normally set, with pedals in the neutral position, to act as a torque compensator. Movement of the pedals varies the pitch. There is a small fixed stabilising surface opposite the hub of the torque or directional control rotor.

Structurally, the Higgins Helicopter has a metal-framed fuselage with a metal-covered cabin and engine compartment. The rear half is covered with fabric over a light fairing structure. The tricycle landing-gear has oleo-sprung main wheels and a steerable nose wheel. The enclosed cabin seats two side-by-side with the controls opposite the left seat. There are two doors, one on each side of the cabin.

HOCKADAY.



The Hockaday Comet Two-seat Cabin Monoplane (130 h.p. Franklin engine).

HOCKADAY AIRCRAFT CORPORATION.

Head Office and Works: 60, East Orange Grove Avenue Burbank, Cal.

President: Noel R. Hockaday.

Secretary and Treasurer: R. I. Hockaday.

The Hockaday Aircraft Corpn. was formed in October, 1937, and at that time the engineering and design of the Hockaday Comet two-seat light cabin monoplane was begun. This proceeded until 1940, when all experimental work was set aside to enable the company to undertake sub-contract work for other aircraft companies.

In the Spring of 1944, work was resumed on the Comet and in June the prototype was test-flown.

THE HOCKADAY CV-130 COMET.

Type.—Two-seat light cabin monoplane.

Wings.—Strut-braced high-wing monoplane. NACA M-6 aerofoil section. Wing structure consists of spruce spars, spruce and plywood ribs, plywood leading-edge, internal wire bracing and an overall covering of fabric. Parallel streamline steel-tube bracing struts with intermediate jury struts. Wing area 156 sq. ft. (14.49 sq. m.). Fabric-covered metal-framed ailerons with external mass-balance.

Fuselage.—Welded steel-tube framework with light wood superstructure, and fabric covering.

Tail Unit.—Wire-braced monoplane type. Welded steel-tube framework covered with fabric. Adjustable tailplane. Streamline wire bracing. Tailplane span 10 ft. 3 in. (3.12 m.).

Landing Gear.—Fixed cantilever type with rubber-cord shock-absorbers. Steerable tail-wheel. Track 6 ft. 3 in. (1.90 m.).

Power Plant.—One 130 h.p. Franklin or 125 h.p. Continental C125 six-cylinder horizontally-opposed air-cooled engine. Two-blade wooden airscrew. Fuel capacity: 24 U.S. gallons (90 litres).

Accommodation.—Enclosed cabin seating two side-by-side with dual wheel controls. Equipment includes engine-driven generator, electric starter, radio, complete blind-flying equipment, etc. Luggage compartment of 5.5 cub. ft. (0.15 cub. m.) capacity aft of seats; allowance 100 lbs. (45 kg.).

Dimensions.—Span 33 ft. (10.05 m.), Length 22 ft. 2 in. (6.76 m.),

Weights and Loadings.—Weight empty 953 lbs. (432 kg.), Disposable load 647 lbs. (293 kg.), Weight loaded 1,600 lbs. (726 kg.), Wing loading (fully) 10.25 lbs./sq. ft. (50 kg./sq. m.), Power loading (fully loaded) 12.8 lbs./h.p. (5.8 kg./h.p.).

Performance.—Maximum speed 140 m.p.h. (225 km.h.), Cruising speed 130 m.p.h. (209 km.h.), Landing speed 50 m.p.h. (80 km.h.), Initial rate of climb 1.150 ft./min. (351 m./min.), Service ceiling 19,000 ft. (5,790 m.), Cruising range 500 miles (805 km.).

HUGHES.

HUGHES AIRCRAFT COMPANY.

Head Office and Works: Florence Avenue at Teale Street, Culver City, Cal.

President: Howard Hughes.

Assistant to President: Glenn E. Odekirk.

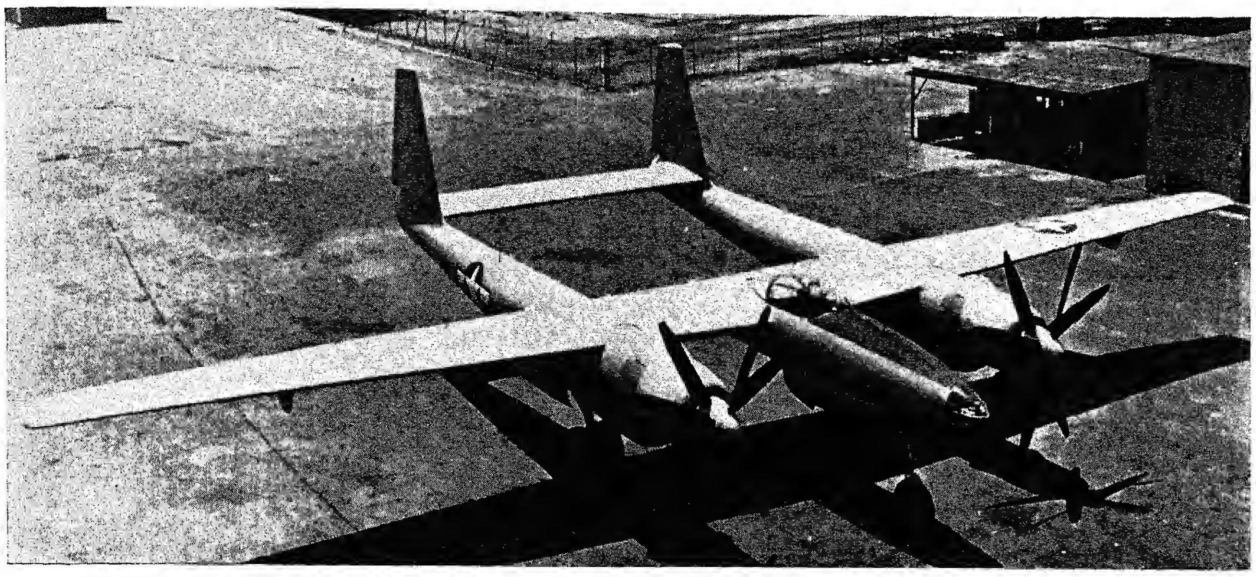
General Manager: Frank McDonnell.

Chief Engineer: Rae Hopper.

The Hughes Aircraft Company was formed in 1936 by Mr. Howard Hughes, a young American sportsman and film producer, to develop a racing monoplane with which he had established the International Landplane Speed Record of 352.46 m.p.h. (563.2 km.h.) on September 12, 1935. With a modified version of this monoplane Mr. Hughes flew non-stop across the United States, a distance of 2,490 miles in 7 hrs. 28 mins., representing an average speed of 332 m.p.h. In July, 1938, he flew round the World in 3 days 19 hrs. 8 mins. in a Lockheed 14 twin-engined monoplane.

The Company's most recent development was a high-speed twin-engined twin-boom experimental monoplane known as the D-2, which Mr. Howard Hughes had under test in 1944. From this aircraft was evolved a military photographic reconnaissance monoplane which carried the U.S. Army designation XF-11. A contract for the production of this type was cancelled in 1945, but two prototypes were completed. The first prototype XF-11, powered by two Pratt & Whitney R-4360 Wasp Major engines, driving eight-blade contra-rotating airscrews, crashed

HUGHES—*continued.*



The Hughes XF-11 Long-range Photographic-Reconnaissance Monoplane (two Pratt & Whitney R-4360-13 engines).

on July 7 1946, on its first flight and Mr. Howard Hughes who was piloting it, was seriously injured.

The Hughes H-4 eight-engined all-wood transport flying-boat mentioned in previous issues of this Annual was moved to Long Beach Dry Dock in June, 1946, for assembly. The power-plant of the H-4 will consist of eight Pratt & Whitney R-4360 Wasp-Major eighteen-cylinder air-cooled radial engines. The H-4 will have a span of 320 ft. (97.5 m.) and a length of 220 ft. (67.1 m.). There will be accommodation for 750 porsons, and the loaded weight is estimated at 225 tons.

In February, 1947, Mr. Howard Hughes appeared before the Senate War Investigating Committee in Washington to explain why the H-4 flying-boat ordered in 1942, and on which eighteen million dollars have already been spent, has not yet flown.

The Hughes Aircraft Company have also undertaken the conversion of certain military aircraft for civilian use.

THE HUGHES XF-11.

The XF-11 is a twin-engined long-range photographic-reconnaissance monoplane which was designed during the war but was not completed until the Summer of 1946.

The aircraft is an all-metal twin-fuselage monoplane of similar layout to that of the P-38 Lightning. The power-plant consists of two 3,000 h.p. Pratt & Whitney R-4360-31 twenty-eight-cylinder air-cooled radial engines each driving two Hamilton Standard Hydromatic four-blade contra-rotating airscrews.

The central nacelle has pressurised accommodation for a crew of two and photographic equipment includes eight cameras, the front three forming a trimetrogon group.

Each unit of the tricycle landing gear carries dual wheels and all units retract backwards, the main units into the fuselage and the nose wheel into the central nacelle.

Dimensions.—Span 101 ft. 4 in. (30.9 m.), Length 65 ft. 5 in. (19.9 m.), Wing area 983 sq. ft. (91.32 sq. m.).

Weights and Loadings.—Maximum weight (4,000 miles=6,400 km. range) 47,500 lbs. (21,565 kg.), Maximum weight (5,000 miles=8,000 km. range) 58,315 lbs. (26,475 kg.), Wing loading (4,000 miles =6,400 km. range) 48.3 lbs./sq. ft. (235.7 kg./sq. m.), Wing loading (5,000 mile=8,000 km. range), 59.3 lbs./sq. ft. (289.4 kg./sq. m.).

Performance.—Maximum speed 450 m.p.h. (720 km.h.) at 33,000 ft. (10,060 m.), Speed at sea level 295 m.p.h. (472 km.h.), Rate of climb 1,000 ft./min. (305 m./min.) to 25,000 ft. (7,625 m.), Climb to 33,000 ft. (10.060 m.) 17.4 min., Service ceiling 42,000 ft. (12,810 m.).

INTERSTATE.

INTERSTATE AIRCRAFT & ENGINEERING CORPORATION.

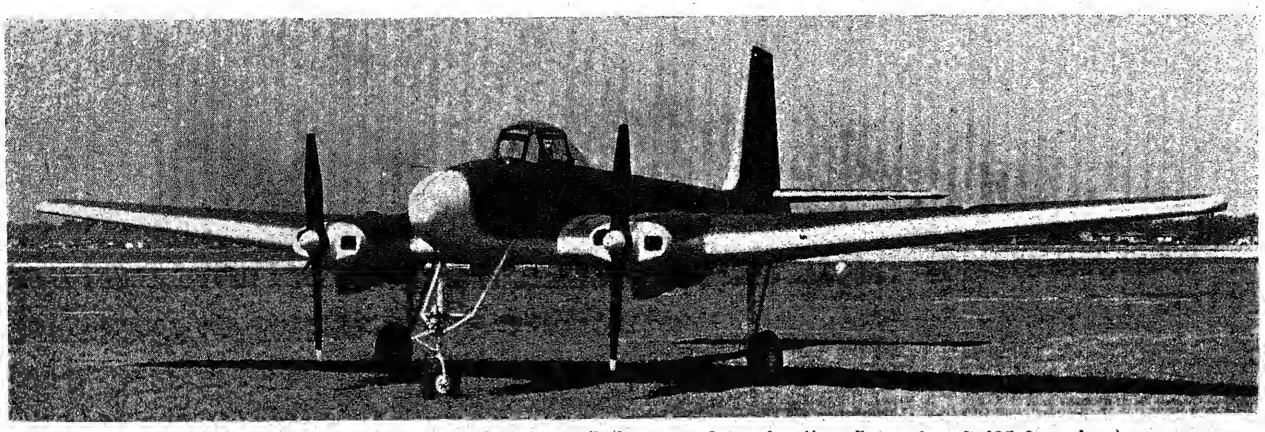
Head Office and Works: El Segundo, Cal.

The Interstate Aircraft and Engineering Corpn. was organized in April, 1937. The corporation designs and manufactures hydraulic units, bomb-shackles, gun-chargers both hydraulic and mechanical, and other precision units and mechanical assemblies for various major aircraft plants.

In 1940 the company produced the Cadet two-seat light cabin monoplane and after America's entry into the war Model S-1B was, at the request of the U.S. Army authorities, developed into a light liaison and observation monoplane of the Grasshopper class. It was originally given the designation XO-63, later altered to XL-6. Several Interstate Models S-1A Cadets acquired secondhand by the U.S. Army authorities were given the designation L-8.

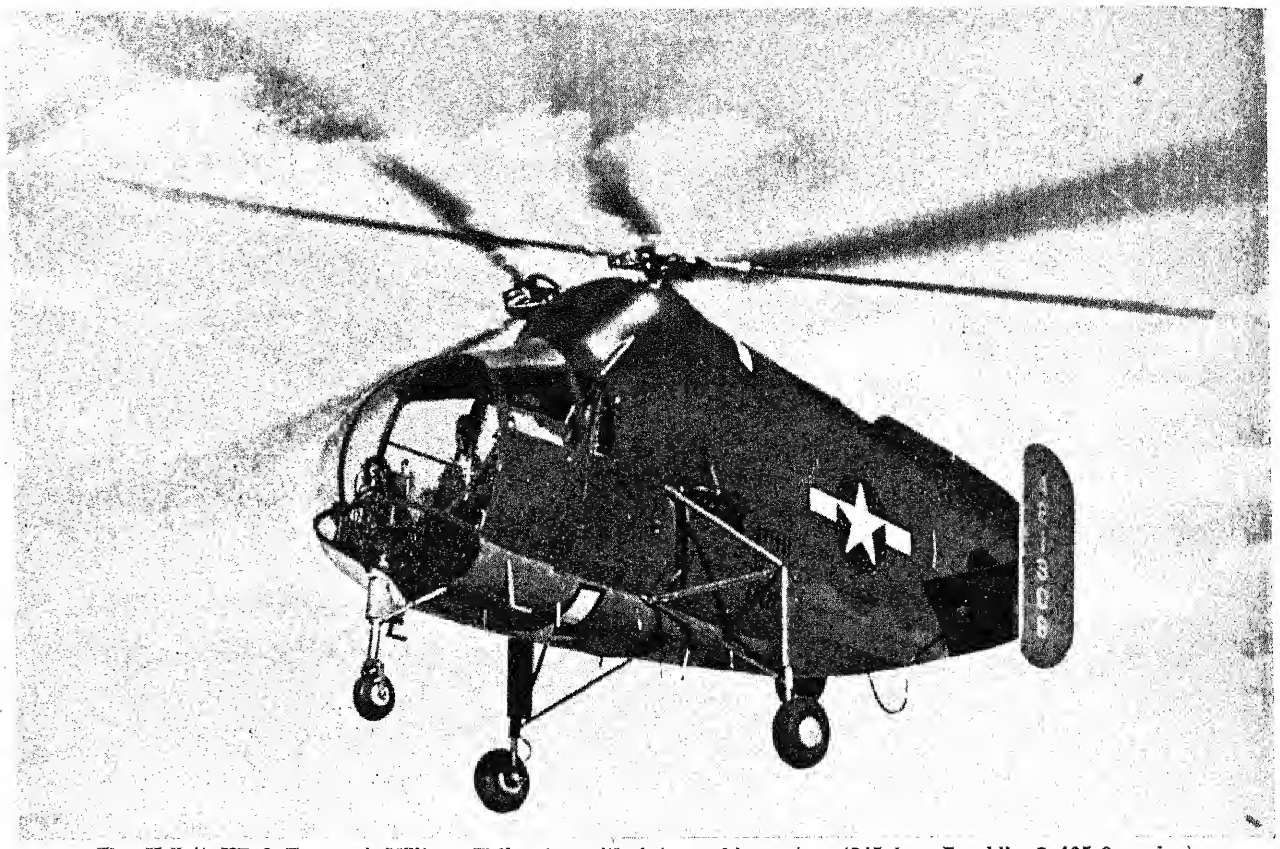
The company also designed and built several prototype aircraft in the Army BQ and Navy TD series. These included the XBQ-4 (TDR-1), XBQ-5, YBQ-6 (TD3R-1) and BQ-6A, all radio-controlled bomb-carriers. All were twin-engined mid-wing monoplanes with provision for carrying up to 2,000 lb. (908 kg.) of explosives, in the form of a bomb, torpedo or depth-charges, when flown remotely without pilot. The XBQ-4, illustrated below, had two Lycoming O-435 engines, the XBQ-5 two Franklin O-805 engines and the YBQ-6 and BQ-6A* had two Wright R-975 radial engines.

In 1945 Interstate abandoned the manufacture of complete aircraft.



The Interstate XBQ-4 Remotely-controlled Pilotless Bomb-carrier (two Lycoming O-435-3 engines).

KELLETT.



The Kellett XR-8 Two-seat Military Helicopter with intermeshing rotors (245 h.p. Franklin O-405-9 engine).

THE KELLETT AIRCRAFT CORPORATION.

Head Office: Lansdowne Avenue above State Road, Upper Darby, Pa.

President: W. W. Kellett.

Executive Vice-President: R. G. Kellett.

Vice-President in Charge of Engineering: R. H. Prewitt.

Vice-Presidents: W. L. Wilson and L. C. Peskin.

Secretary and Treasurer: W. R. Yarnall.

The Kellett Aircraft Corpn., formerly the Kellett Autogiro Corpn. assumed its present name in June, 1943, because of the larger scope of the aviation activities in which it was then engaged. It has still, however, maintained the development and manufacture of rotary-wing aircraft, in which it has been engaged since 1929.

In 1943 the Company completed the delivery to the U.S.A.A.F. of a small service development order for the YO-60 Autogiro, and with the completion of that order the company abandoned the manufacture of autogiros.

Kellett has been engaged in helicopter development work for several years and during 1944 the XR-8 helicopter, developed for the U.S. Army Air Forces, was successfully flown. A description of this aircraft follows.

Present plans include the development of larger transport helicopters for military and commercial use, one of which, the KH-2 is described herewith.

THE KELLETT KH-2.

The KH-2 is an all-metal commercial helicopter which is now under development. It will incorporate the twin-meshing-rotor system of the XR-8 but is otherwise a completely new design. The larger fuselage will have accommodation for pilot and ten passengers or, in a freight version, a total cargo volume of 589 cub. ft. (17.7 cu. m.).

The two 550 h.p. Continental R9-A nine-cylinder radial air-cooled engines will be mounted in faired sponsons springing from the sides of the fuselage, these sponsons also housing the main wheels of the fixed tricycle landing-gear. The rotor drive will be by inclined external shafts between the sponsons and the faired rotor pylons.

The tail-unit will consist of a monoplane horizontal surface and triple vertical surfaces.

Dimensions.—Overall width (over rotors) 69 ft. 4 in. (21.1 m.), Overall length 65 ft. (19.8 m.), Overall height 19 ft. (5.8 m.), Rotor diameter (3-blade) 65 ft. (19.8 m.).

Weights and Loadings (Designed).—Weight empty 8,658 lbs. (3,930 kg.), Weight loaded 11,600 lbs. (5,270 kg.), Rotor disc loading 3.13 lbs./sq. ft. (15.27 kg./sq. m.), Power loading 10.55 lbs./h.p. (4.8 kg./h.p.).

Performance (Estimated).—Maximum speed 118 m.p.h. (189 km.h.), Cruising speed 90 m.p.h. (144 km.h.), Cruising range 180 miles (290 km.), Absolute ceiling over 15,000 ft. (4,575 m.).

THE KELLETT XR-8.

The prototype XR-8 made its first flight on August 7, 1944, and it has since been subjected to service trials and development under the supervision of the U.S.A.A.F. The twin-rotor arrangement is designed to eliminate the necessity for an anti-torque tail rotor, and to utilise all available power for direct lift.

Type.—Two-seat Military helicopter.

Rotors.—Twin counter-rotating intermeshing rotors, 36 ft. 0 in. (10.97 m.) diameter, with hubs 4 ft. 0 in. (1.22 m.) apart. Upper horizontal transmission unit mounted on vertical unit on two ball bearings allowing it to rotate through 29 degrees independently of the lower housing, which is rigidly mounted in fuselage. It is further supported on two ball-bearings mounted on the pylon, which allow the rotor to tilt through 16 degrees for trimming. Lower unit connected to engine by universal shaft drive and rubber-cushioned driving flange. Rotor transmission is through two pairs of spiral bevel gears, with a reduction ratio of 13.189 : 1. Integral friction and dog-clutch assembly whereby rotors are brought to engine speed by friction-clutch, engagement of dog-clutch providing positive drive. Over-riding dog-clutch permits emergency dis-engagement. Friction-clutch plate acts also as rotor brake. Blade area (total) 84.5 sq. ft. (8.85 sq. m.).

Fuselage.—Deep-section metal structure covered with metal forward and with fabric aft.

Tail Unit.—Strut-braced short-span tailplane mounting twin fins as endplates. Fins of metal construction with fabric covering. Additional dorsal fin at rear end of fuselage.

Landing Gear.—Fixed tricycle type. Main wheels carried on shock-absorber legs braced to fuselage by steel-tube triangulated structure. Track 10 ft. 0 in. (3.05 m.). Full-swivelling nose-wheel. Emergency bumper-skid below rear fuselage.

Power Plant.—One 245 h.p. Franklin six-cylinder horizontally-opposed air-cooled engine mounted in fuselage behind cabin. Radial cooling fan acts also as flywheel and is bolted directly to crank-shaft. Air intake above cabin also provides oil cooling. Normal fuel capacity 34 U.S. gallons (128 litres); maximum fuel capacity 81 U.S. gallons (306 litres).

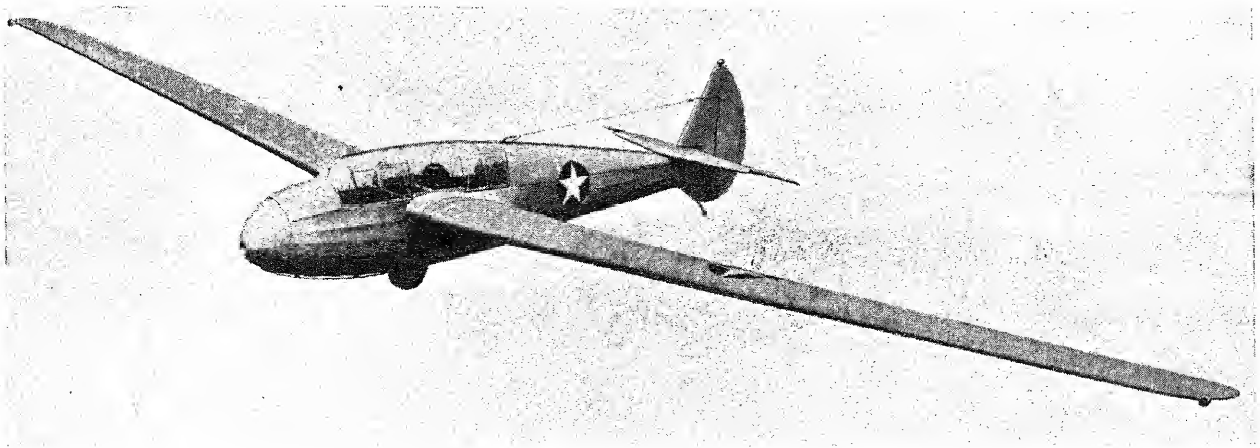
Accommodation.—Entire nose covered by moulded Plexiglas forms cabin with seats for pilot and observer side by side. Dual controls, consisting of conventional control column and pedals. Vertical-flight control lever, with throttle, extends forward from between seats. Transmission clutch control, with combined rotor brake, extends forward from vertical housing.

Dimensions.—Rotor span (overall) 40 ft. 0 in. (12.19 m.), Rotor diameter (single) 36 ft. 0 in. (10.97 m.), Fuselage length 22 ft. 7 in. (6.88 m.), Height 11 ft. 0 in. (3.35 m.).

Weights and Loadings.—Weight empty 2,320 lbs. (1,052 kg.), Weight loaded 2,975 lbs. (1,349 kg.). Blade loading 35.2 lbs./sq. ft. (171.88 kg./sq. m.), Power loading 12.14 lbs./h.p. (5.5 kg./h.p.).

Performance (Approximate).—Forward level speed 100 m.p.h. (161 km.h.), Ceiling 10,000 ft. (3,048 m.), Motionless hovering up to 3,000 ft. (914 m.).

LAISTER-KAUFFMANN.



The Laister-Kauffmann LK-10B (TG-4A) Two-seat Training Glider.

LAISTER-KAUFFMANN AIRCRAFT CORPORATION.

Head Office : 6376, Clayton Road, St. Louis 17, Mo.
President and Chief Engineer : John W. Laister.
Vice-President : M. Nanson Whitehead.
Secretary and Treasurer : John R. Kauffmann.
Assistant Secretary : William F. Nesbit.

During the war the Laister-Kauffman Aircraft Corpn., devoted its energies mainly to the production of the Waco CG-4A troop-carrying and cargo glider. When the original contract was completed shortly after the middle of 1944, the company initiated an extensive repair and re-building programme on gliders of this same model which had been damaged in training.

The Laister-Kauffman Corporation has obtained a CAA certificate for a civil version of the Army TG-4A two-seat training glider to be known as the LK-10B Yankee-Doodle Two.

In January, 1944, the Corpn. acquired the Bowlus Sailplane Co., Inc., by an exchange of shares, and thereby acquired manufacturing facilities on the Pacific coast. Bowlus types taken over by Laister-Kauffmann included the Baby Albatross, a light single-seat glider which will be marketed complete or in kit form for home building.

THE LAISTER-KAUFFMANN LK-10B.

Type.—Two-seat Training glider.

Wings.—Mid-wing cantilever monoplane. Aerofoil section NACA 4418-12. Welded steel-tube centre-section integral with fuselage structure. Outer wing sections have single wooden box-spar, a stressed plywood leading-edge and a normal ribbed structure aft of the spar, the whole being covered with fabric. Statically-balanced ailerons hinged to false spar. Spoilers on upper surface inboard of ailerons are linked to operate with the wheel brake. Wing area 166 sq. ft. (15.42 sq. m.).

Fuselage.—Welded seamless steel-tube framework covered with fabric over a light wood fairing structure. Centre-section spar and adjacent structure is heat-treated as a separate unit and welded into the fuselage truss.

Tail Unit.—Cantilever monoplane type, with wooden framework and fabric covering. Statically-balanced movable surfaces. Trimming-tabs in both elevators and rudder.

Landing Gear.—Single wheel built into fuselage on centre-line.

Accommodation.—Tandem cockpits fore and aft of the centre-section spar with sliding canopy over each. Dual controls.

Dimensions.—Span 50 ft. (15.24 m.), Length 21 ft. 3 in. (6.48 m.), Height 4 ft. (1.22 m.).

Weights and Loadings.—Weight empty 475 lbs. (216 kg.), Weight loaded 875 lbs. (397 kg.), Wing loading 5.27 lbs./sq. ft. (25.7 kg./sq. m.).

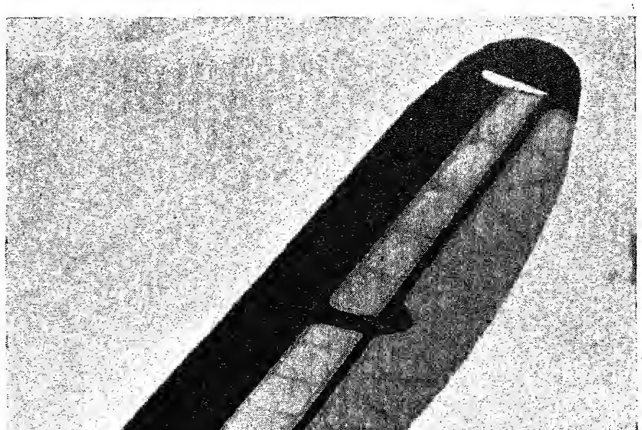
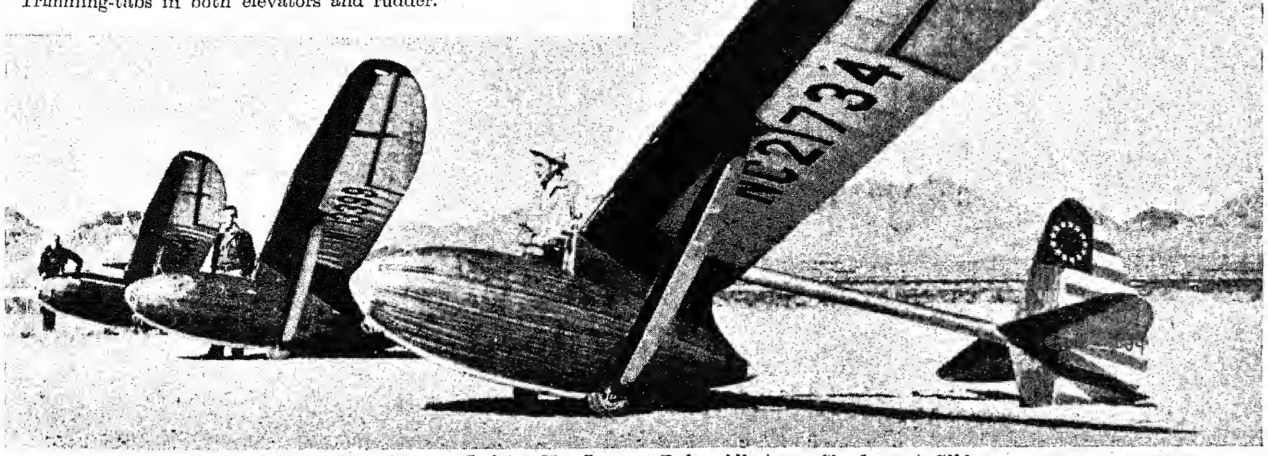
THE LAISTER-KAUFFMANN BABY ALBATROSS.

The Baby Albatross is a single-seat glider of all wood construction which is available complete or in kit form for home construction.

Dimensions.—Span 44 ft. 4 in. (13.52 m.), Length 19 ft. 2 in. (5.84 m.).

Weights and Loadings.—Weight empty 250 lbs. (113.5 kg.), Weight loaded 450 lbs. (204.3 kg.), Wing loading 3.5 lbs./sq. ft. (17 kg./sq.m.).

Performance.—Aircraft towing speed up to 65 m.p.h. (104 km.h.), Sinking speed 2.25 ft./sec. (.68 m./sec.), Gliding angle 20 : 1.

A line-up of three Laister-Kauffmann Baby Albatross Single-seat Gliders.

LANDGRAF.

THE LANDGRAF HELICOPTER COMPANY.

Head Office and Works : 1440 West 166th Street, Gardena, California.
President and Treasurer : Fred Landgraf.
Vice-President and Secretary : James S. Ricklefs.

The Landgraf Helicopter Company was incorporated on September 20, 1943. The Model H-2 helicopter had been under development for some years previous to that date under the guidance of its inventor-designer Mr. Fred Landgraf. This experimental model was first flown on November 2, 1944. In

LANDGRAF—*continued.*

The Landgraf Model H-2 Twin-Rotor Helicopter (85 h.p. Pobjoy Type R engine).

1945 the Landgraf Company received an experimental contract from the U.S. Army for development of the H-2.

The Landgraf Model H-2 helicopter has a number of revolutionary design features, among which are a cyclically-controlled aileron system on the tips of the rotor blades; automatic collective pitch control; a centre of gravity ahead of the rotor axes; a retractable tricycle landing-gear designed to withstand a vertical power-off landing; and rotors which are overlapping and sychronised.

The Landgraf Company is also developing the Model H-3 two/three-seat and the Model H-4 five/eight-seat Helicopters, brief details of which follow.

THE LANDGRAF MODEL H-2 HELICOPTER.

Type.—Experimental Single-seat Twin-rotor helicopter.

Rotors.—Two three-blade overlapping rotors, 16 ft. 0 in. (4.87 m.) diameter, rigidly attached to metal hubs 11 ft. 0 in. (3.35 m.) apart at extremities of sloping booms projecting from sides of fuselage. NACA 0015 aerofoil section, faired to oval section at roots. Solid birch leading-edge with plywood covering aft. Ailerons on blade tips for attitude control. Pitch of all blades is the same and is automatically controlled through a centrifugally-operated spring-loaded device. Rotor speed 485 r.p.m. Effective disc area 360 sq. ft. (33.44 sq. m.); total blade area 32.4 sq. ft. (3 sq. m.).

Fuselage.—Wooden monocoque structure with plywood skin. Booms of similar construction.

Tail Unit.—Single cantilever stabilising fin built integrally with fuselage.

Landing Gear.—Retractable tricycle type. Main wheels, carried on air-oil shock-absorber struts attached to wing, retract inwards into fuselage. 20 in. (50.8 cm.) travel on main legs to take vertical power-off landing. Steerable nose-wheel retracts backwards into fuselage.

Power Plant.—One Pobjoy R seven-cylinder radial blower-cooled engine on steel-tube mounting aft of pilot's cockpit developing 85 b.h.p. at 3,300 r.p.m. Fuel capacity 6.5 U.S. gallons (24.5 litres); oil capacity 1 U.S. gallon (3.77 litres).

Accommodation.—Pilot's enclosed cockpit in nose, with entry door on starboard. Flying controls consist of a single control column and throttle.

Dimensions.—Span 27 ft. 0in. (8.23 m.), Rotor diameter (each) 16 ft. 0 in. (4.87 m.), Fuselage length 15 ft. 0 in. (4.57 m.).

Weights and Loadings.—Weight empty 636 lbs. (288 kg.), Weight loaded 850 lbs. (386 kg.), Disc loading 2.36 lbs./sq. ft. (11.5 kg./sq. m.), Blade loading 26.2 lbs./sq. ft. (127.8 kg./sq. m.), Power loading 10 lbs./h.p. (4.54 kg./h.p.).

Performance.—Maximum speed over 100 m.p.h. (161 km.h.).

THE LANDGRAF MODEL H-3 HELICOPTER.

The H-3 is a projected all-metal development of the experimental H-2 helicopter with accommodation for a pilot and one or two passengers. The proposed power-plant is a 125-135 h.p. Continental horizontally-opposed air-cooled engine. Gear reduction ratio will be 7.25 : 1, and the rotor speed 380 r.p.m.

Dimensions.—Rotor diameter (each) 21 ft. 8 in. (6.60 m.), Rotor centres 15 ft. 0 in. (4.57 m.).

Weights and Loadings.—Weight loaded 1,640 lbs. (744 kg.), Effective disc loading 2.46 lbs./sq. ft. (12 kg./sq. m.), Power loading 12.15 lbs./h.p. (5.51 kg./h.p.).

Performance (Estimated).—Cruising speed 117 m.p.h. (188 km.h.), Range 424 miles (682 km.).

THE LANDGRAF MODEL H-4 HELICOPTER.

The H-4 is a projected all-metal five/eight-seat commercial helicopter similar in general form to the above. The power-plant is to be a 450 h.p. Pratt & Whitney radial engine, driving the twin rotors through a reduction gearing ratio of 12 : 1, the rotor speed being 191 r.p.m.

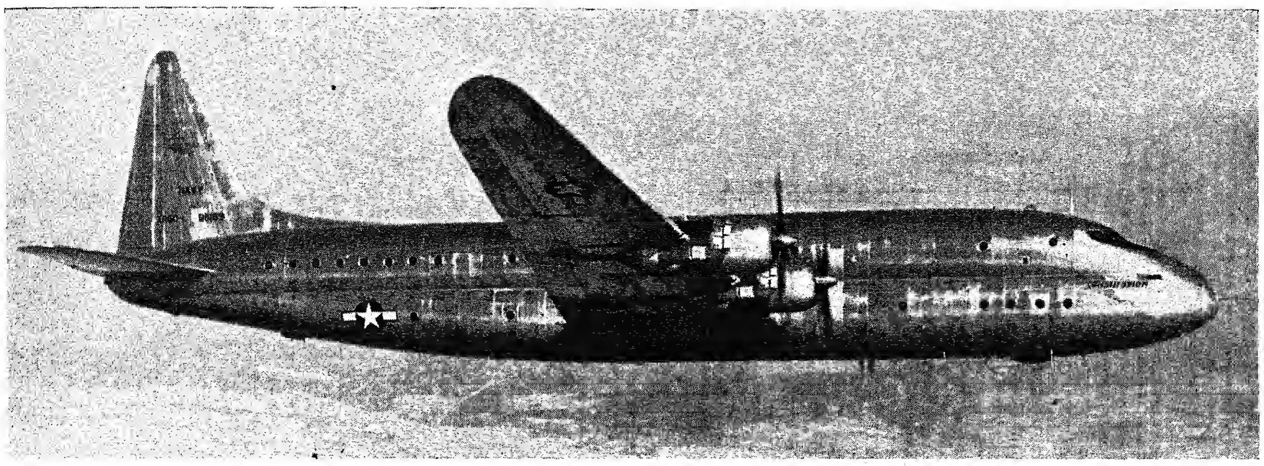
Dimensions.—Rotor diameter (each) 40 ft. 0 in. (12.19 m.), Rotor centres 25 ft. 0 in. (7.62 m.).

Weights and Loadings.—Loaded weight 5,630 lbs. (2,554 kg.), Effective disc loading 2.57 lbs./sq. ft. (12.54 kg./sq. m.), Power loading 12.51 lbs./h.p. (5.71 kg./h.p.).

Performance (Estimated).—Cruising speed 136 m.p.h. (219 km.h.), Range 580 miles (933 km.).

The Landgraf Model H-2 Twin-rotor Helicopter (85 h.p. Pobjoy Type R engine).

LOCKHEED.



The Lockheed XR60-1 Constitution Naval Transport (four 3,500 h.p. Pratt & Whitney R-4360 engines).

THE LOCKHEED AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: BURBANK, CALIFORNIA.
Incorporated: 1932.
President: Robert E. Gross.
Vice-President and General Manager: Courtland S. Gross.
Vice-President in charge of Administration: Cyril Chappellet.
Vice-President in charge of Sales: Carl B. Squier.
Vice-President in charge of Engineering: Mac Short.
Vice-President and Chief Engineer: Hall L. Hibbard.
Vice-President in charge of Materiel: H. E. Ryker.
Vice-President in charge of Finance and Treasurer: Charles A. Barker, Jr.
Secretary: L. W. Wulfekuhler.
Controller: Dudley E. Browne.

The original Lockheed Aircraft Co. dates from 1916 when the brothers Allen and Malcolm Loughead, the founders, began with what was the forerunner of the true streamline aeroplane. The factory was moved to Burbank, Cal., the present site, in 1926, and the name changed to Lockheed.

On November 30, 1943, the Vega Aircraft Corporation, which had been formed in 1937 as an affiliate, and in 1941 became a wholly-owned subsidiary of the Lockheed Aircraft Corpn., was absorbed and the name Vega has now been abandoned.

In the 6½ years beginning in 1939, when Lockheed began delivering Hudsons to the British Government, to VJ-Day, 19,273 complete aircraft were delivered to the U.S. and Allied Governments. In 1945 Lockheed built 2,827 aircraft, including 1,553 P-38 Lightnings, 231 P-80 Shooting Stars, 26 C-69 Constellations, 466 PV-2 Harpoons and 551 B-17 Fortresses.

After VJ-Day the P-38, C-69 and PV-2 contracts were cancelled. The P-80 has continued in production with schedules for delivery of more than 900 in 1946 and 1947. With the cancellation of the C-69 contract the conversion of the Constellation to its original civil status was rapidly achieved, the first Constellations delivered to airlines being aircraft which had been begun as military C-69 transports. A Constellation delivered to T.W.A. early in 1946 was the 20,000th all-metal aircraft to be built by the Lockheed Corporation.

During 1946, Lockheed delivered 57 Constellations to domestic and foreign airlines, 398 P-80A Shooting Stars to the U.S. Army and the first P2V-1 Harpoons of a U.S. Navy contract. Two prototypes of the XR60-1 Constitution and the first Saturn were also completed.

The Lockheed Company during the closing stages of the War formed a Special Projects Division to conduct a limited amount of commercial research independently of the major military work then in hand. This division was charged with the investigation of the future possibilities of the private-plane market, including the study of suitable light aircraft and research into the helicopter field.

The company have since announced the abandonment of its personal plane programme, and the merging of the Special Projects Division with the main engineering department. Helicopter research continues.

THE LOCKHEED XP-90.

The XP-90 is a high-speed combination jet and rocket fighter which is under development for the U.S.A.A.F. It is said to be designed for a maximum speed of 630 m.p.h. (1,010 km.h.), with rocket boost equipment to give an added 60 m.p.h. (96 km.h.) for emergency use. The aircraft will be smaller than the P-80 and will have very thin laminar-flow wings and a pointed fuselage nose. No further details are available.

THE LOCKHEED MODEL 89 AND 189 CONSTITUTION.

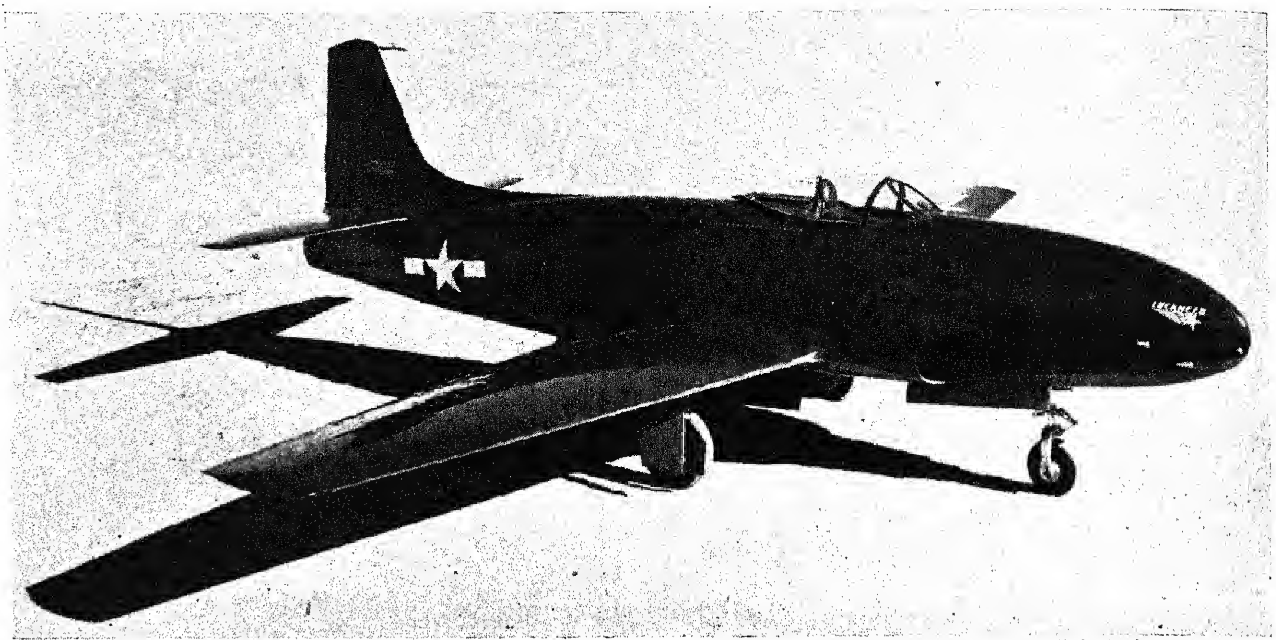
U.S. Navy designation: XR60-1.

The Constitution is a large four-engined transport which was designed with a view to its ultimate use as a commercial transport to carry a crew of 11 and 128 passengers. The pressurized fuselage, of figure-8 cross-section, is divided into two decks. When the upper deck only is used for passengers there is 7.405 cub. ft. (309.6 cub. m.) freight space on the lower deck.

Two prototype aircraft have been built to the order of the U.S. Navy under the designation XR60-1. The power-plant of this version (Model 89) consists of four 3,500 h.p. Pratt & Whitney R-4360 Wasp Major 28-cylinder four-row radial air-cooled engines, which will give the aircraft a designed cruising speed of 237 m.p.h. (379 km.h.) and range of 2,300 miles (3,700 km.).

The Lockheed XR60-1 Constitution Naval Transport (four 3,500 h.p. Pratt & Whitney R-4360 engines).

***LOCKHEED**—continued.*



The Prototype XP-80 Shooting Star which was built round the de Havilland H-1 turbo-jet engine. It is to be lodged in the Smithsonian National Air Museum.

A further development of the Constitution (Model 189) is planned with four gas turbines driving contra-rotating airscrews. It is estimated that four airscrew gas-turbines, each giving the equivalent of 5,000 h.p., will raise the cruising speed to about 350 m.p.h. (563 km.h.) and the maximum speed to about 400 m.p.h. (644 km.h.).

Owing to shortage of certain materials, completion of the prototypes was delayed and provisional orders for a commercial version of the Model 89 which had been placed by Pan American World Airways and American Overseas Airlines were cancelled. Interest is, however, likely to be revived in a commercial version of the Model 189.

DIMENSIONS.—Span 189 ft. 0 in. (57.6 m.), Length 156 ft. 0 in. (47.55 m.), Height 50 ft. 0 in. (15.24 m.), Wing area 3,610 sq. ft. (335.36 sq. m.).

WEIGHTS AND LOADINGS (Designed—Model 89).—Weight loaded 189,000 lbs. (85,729 kg.), Wing loading 52.4 lbs./sq. ft. (287.7 kg./sq. m.), Power loading (approximate) 15.8 lbs./h.p. (7.15 kg./h.p.).

THE LOCKHEED MODEL 80 SHOOTING STAR.

U.S. Army Air Force designations : P-80A and FP-80A.

The Shooting Star was the first jet-propelled combat aircraft to be accepted by the U.S. Army Air Forces. The XP-80 was designed round a British de Havilland H-1 jet-unit which was supplied to the American authorities in July, 1943, and turned over by Wright Field to the Lockheed company to power the prototype. In 143 days Lockheed had designed, built and flown the XP-80, the first flight of the prototype being made on January 9, 1944. Later, a General Electric power-unit was adopted for the YP-80A and the production P-80A.

The first photographic versions of the Shooting Star were designated XF-14 and XF-14A, but only two aircraft were so identified. The P.R. version is now known as the FP-80A. The camera nose with three vertical cameras is inter-changeable with the gun nose of the P-80A.

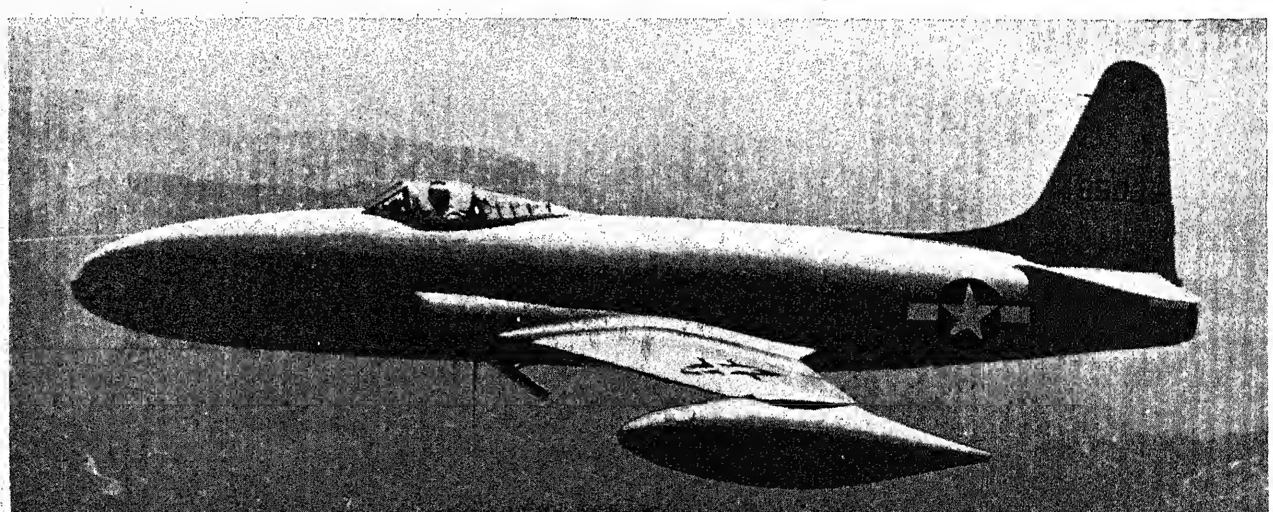
The XP-80B is a special cleaned-up version of the Shooting Star which, up to the time of writing, had made several fruitless attempts to establish a new World's Speed Record at Muroc, Cal. It has a smaller bubble canopy, buried air intake scoops flush with the sides of the fuselage and a new wing of greater chord.

TYPE.—Single-seat jet-propelled Fighter.

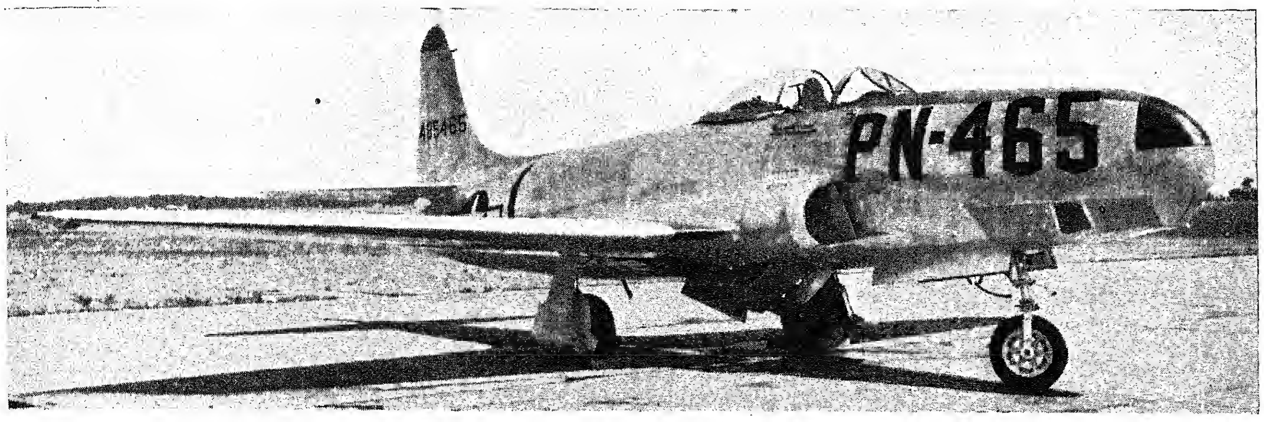
WINGS.—Cantilever low-wing monoplane. NACA laminar-flow aerofoil section with knife-sharp leading-edge. Centre-line of chord 2 in. (5.08 c/m.) behind mid-point of fuselage. Wings of equal taper and no dihedral. Aluminium-alloy structure with I-section spars, T-section longitudinal stringers and stressed metal skin. Wing area 237 sq. ft. (22 sq. m.). Normal ailerons of all-metal construction with hydraulic boost control. Trim-tab in port aileron. Electrically-operated split trailing-edge flaps inboard of ailerons with separate fuselage flaps interconnected with wing flaps. Fuselage flaps may be operated with or separately from wing flaps.

FUSELAGE.—All-metal semi-monocoque structure in three sections consisting of nose, centre and aft sections. Nose-section detachable. Centre fuselage extending from front of cockpit to wing trailing-edge has main longerons, vertical frames and longitudinal stringers, with flush-riveted smooth metal skin. Detachable inspection panel over jet unit. Aft section consists of tapered longerons, vertical frames and longitudinal stringers and incorporates jet tail pipe and integral tail unit.

TAIL UNIT.—Cantilever monoplane type. All-metal fin and tailplane, integral with rear section of fuselage, have two spars, former ribs and stressed metal covering. Plastic tip to fin houses radio



The Lockheed P-80A Shooting Star Single-seat Fighter (General Electric I-40 turbo-jet engine).



The Lockheed FP-80A Shooting Star, the Photographic-Reconnaissance version of the P-80A Fighter.—(*Peter Bowers*).

antenna. Balanced rudder and elevators of all-metal construction with metal skin. Controllable inset trim-tab in each elevator; adjustable rudder trim-tab. Tailplane span 15 ft. 7 in. (4.75 m.).

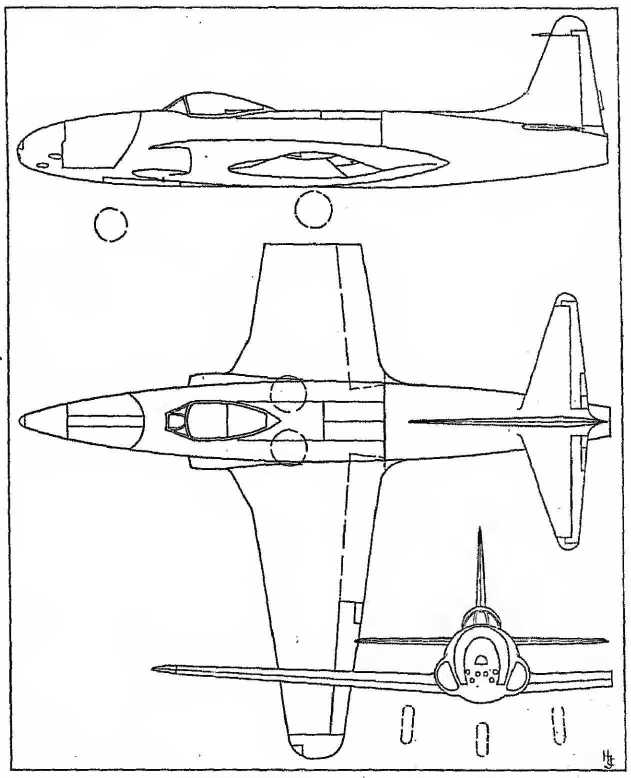
Landing Gear.—Retractable tricycle type. Each main wheel, carried on inner side of single shock-absorber leg with side link member, retracts inwards into wing and is completely enclosed by fairing plates attached to outside of leg and under fuselage. Nose-wheel carried on sprung half-fork retracts backwards into fuselage and is enclosed by twin doors. Hydraulic operation. Triple-tread tyres on all wheels.

Power Plant.—One General Electric I-40 (Army designation J-33) centrifugal-flow jet-propulsion unit in centre-section of fuselage with air-intakes on either side of fuselage forward of wing leading-edge. Aft section of fuselage, including jet nozzle, removed by detaching three fittings and tail pipe clamp for servicing and maintenance of jet unit. Complete unit may be changed in 20 minutes. Self-sealing kerosene fuel tanks in fuselage and wings. Streamlined long-range fuel-tanks each of 165 U.S. gallons (623 litres) capacity may be carried on electrically-operated drop shackles under wing-tips.

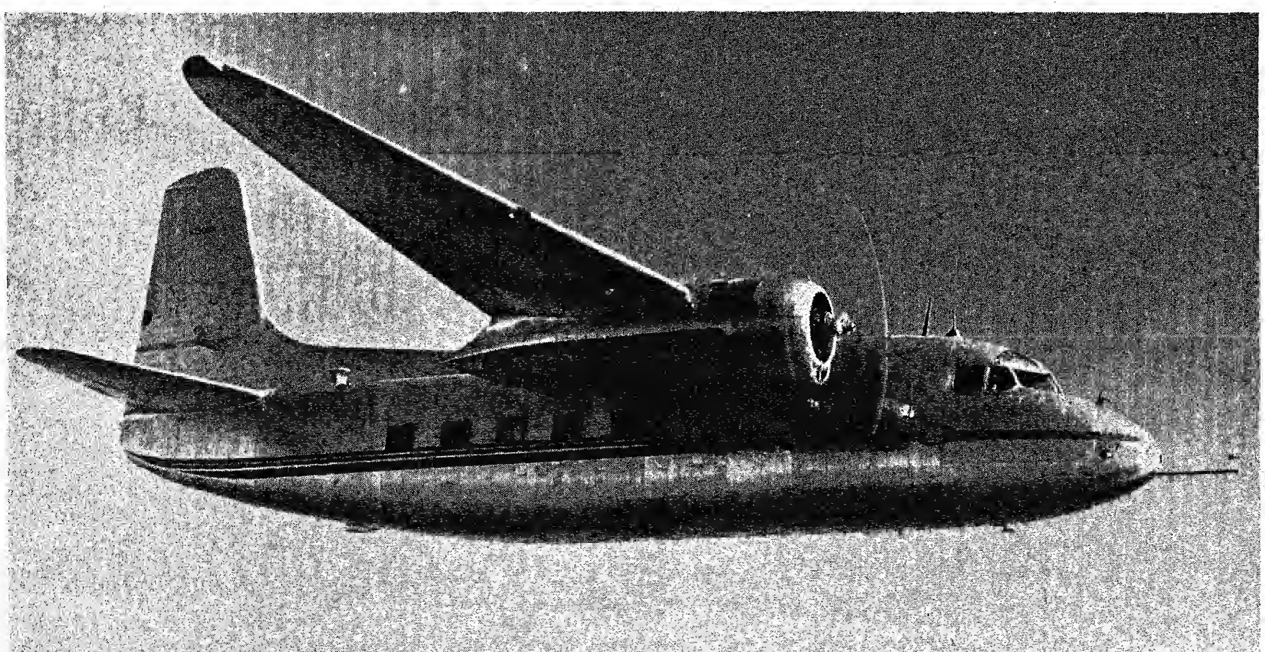
Accommodation.—Pressurized cockpit for pilot over wing leading-edge. Moulded cockpit cover slides backwards for access. Flat armoured windscreen. Steel armour plate on upper forward side of front bulkhead and behind pilot's seat and head, with duralumin armour plate aft of front bulkhead. Cockpit pressure automatically reduced when combat gun-switch is used to prevent physical injury to pilot from explosive decompression should canopy be pierced. Provision for use of anti-G suit.

Armament.—Six .5 in. (12.7 m/m.) forward-firing machine-guns in lower portion of nose with 300 r.p.g. Electric gyro-lead computing gun-sight with reflex optical system. Guns and magazines may be removed and replaced in 15 minutes without use of platforms or ladders. Bombs may be carried on wing-tip shackles in place of long-range tanks.

Equipment.—Complete gun-nose can be replaced by nose-section containing camera equipment for photographic-reconnaissance duties. This includes one K-17 with 6 in. (15.24 c/m.) lens and two K-22 with 24 in. (60.9 c/m.) lens, and Fairchild automatic RDF sets. Camera gun in slight bulge in starboard intake. Oxygen, radio and adjustable landing-light in nose section; hydraulics and radio in fuselage centre-section below cockpit.



The Lockheed P-80A Shooting Star.



The prototype Lockheed Saturn Light Transport (two Continental GR9A-975 engines).

LOCKHEED—*continued.*

DIMENSIONS.—Span 38 ft. $10\frac{1}{2}$ in. (11.80 m.), Length 34 ft. 6 in. (10.50 m.), Height overall 11 ft. 4 in. (3.45 m.). Total area of control surfaces (ailerons, elevators and rudder) 31.9 sq. ft. (2·93 sq. m.).

WEIGHTS AND LOADINGS (Approximate).—Weight empty 8,000 lbs. (3,629 kg.), Maximum take-off weight 14,000 lbs. (6,350 kg.), Wing loading (at maximum weight) 59 lbs./sq. ft. (288 kg./sq. m.).

PERFORMANCE.—Maximum speed 558 m.p.h. (898 km.h.) at sea-level, Maximum speed at 30,000 ft. (9,145 m.) 508 m.p.h. (818 km.h.), Service ceiling, over 45,000 ft. (13,716 m.), Maximum range (approximate) 2,000 miles (3,219 km.).

THE LOCKHEED MODEL 75 SATURN.

The Saturn was designed primarily as an economical feeder-line transport. One of its features is the interchangeability of right and left side components, including landing-gear, landing-gear doors, power-plant units, engine cowlings, elevators and tabs and wing-flap assemblies.

The first prototype flew in June, 1946, but owing to the unavailability of Continental engines the original production programme for the Saturn has been shelved. A second prototype fitted with two Wright Cyclone seven-cylinder engines is being completed and if this installation is satisfactory the possibilities of production will be re-examined.

TYPE.—Twin-engined 14-passenger monoplane.

WINGS.—Cantilever high-wing monoplane. All-metal structure consisting of constant-chord centre-section and two sharply-tapered outer sections. All-metal ailerons with trim-tabs in each and trailing-edge flaps. Ailerons and flaps interchangeable left and right.

FUSELAGE.—All-metal structure of oval cross-section.

TAIL UNIT.—Cantilever monoplane type. Balanced rudder and elevators with trim-tab in rudder, and trim and balance-tab in elevators. Elevators interchangeable left and right. Dorsal fin extends along fuselage. Tailplane span 24 ft. 8 in. (7.52 m.).

LANDING GEAR.—Retractable tricycle type. Main units each consist of single shock-absorber leg carrying two wheels which retract forward into engine nacelles and are enclosed by twin doors. Track (centre-line of legs) 18 ft. 4 in. (5.59 m.). Nose-wheel retracts rearward into fuselage.

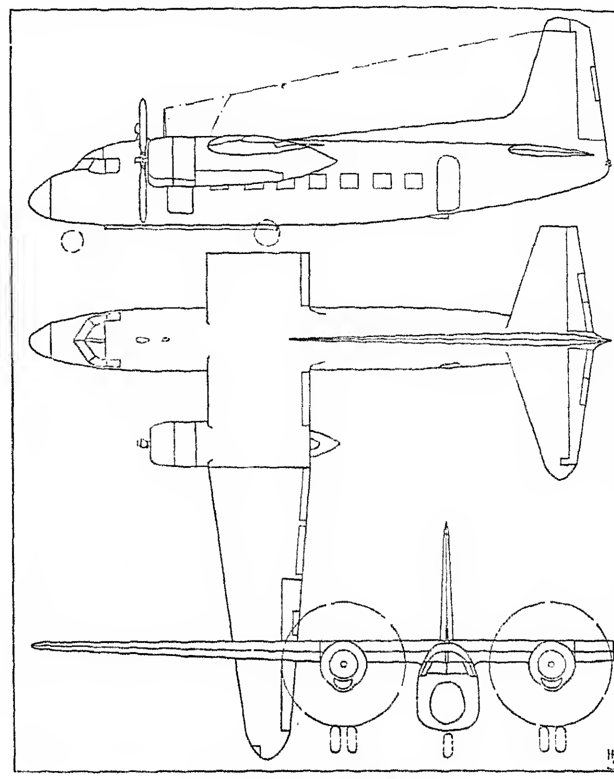
POWER PLANT.—Two Continental GR9A-975 nine-cylinder radial air-cooled engines, each with normal rating of 550 h.p., and with 600 h.p. available for take-off. Alternatively two 800 h.p. Wright C7B Cyclone seven-cylinder radial air-cooled engines may be installed. Aeroproducts two-blade paddle-type airscrews. Fuel capacity 492 U.S. gallons (1,862 litres), Oil capacity 20 U.S. gallons (76 litres).

ACCOMMODATION.—Crew of two. Main passenger cabin has normal accommodation for 14 passengers. Entry door on port side at rear 2 ft. 10 in. (0.86 m.) from ground. Forward freight compartment between crew compartment and main cabin with capacity of 112 cub. ft. (3.16 cub. m.). Access door on port side 3 ft. 2 in. (0.96 m.) from ground. Rear freight compartment with capacity of 50 cub. ft. (1.4 cub. m.). Quickly removable bulkheads between passenger cabin and freight compartments to permit variation in loads.

DIMENSIONS.—Span 74 ft. 0 in. (22.56 m.), Length 51 ft. 6 in. (15.7 m.), Height (over rudder) 19 ft. 10 in. (6.04 m.).

WEIGHTS (Designed).—Weight empty 9,634 lbs. (4,370 kg.), Operating weight empty, including crew and baggage, minimum and reserve oil, and 42 lbs. (19 kg.) of passenger equipment, 10,200 lbs. (4,627 kg.), Weight loaded 14,000 lbs. (6,350 kg.).

PERFORMANCE (Estimated).—Maximum speed 248 m.p.h. (399 km.h.), Cruising speed (60% power) 207 m.p.h. (343 km.h.) at 10,000 ft. (3,050 m.), Cruising speed (60% power) at sea level 189 m.p.h. (304 km.h.), Rate of climb at sea level 1,460 ft./min. (445 m./min.), One-engine rate of climb at 5,000 ft. (1,525 m.) 370 ft./min. (113 m./min.), Service ceiling 26,000 ft. (7,955 m.), One-engine ceiling 15,000 ft. (4,570 m.), Cruising range, at 196 m.p.h. (315 km.h.) at 10,000 ft. (3,050 m.) with 2,740 lbs. (1,243 kg.) payload, 500 miles (805 km.), Range at 175 m.p.h. (282 km.h.) at 5,000 ft. (1,525 m.) with 3,280 lbs. (1,488 kg.) payload, 150 miles (242 km.), Maximum range, approximately 2,000 miles (3,220 km.), Take-off distance to 50 ft. (15 m.) 623 yds. (270 m.), Landing distance from 50 ft. (15 m.) 597 yds. (546 m.).



The Lockheed 75 Saturn.

THE LOCKHEED MODELS 49, 649 AND 749 CONSTELLATION.

The original Model 49 Constellation was designed before the war to the requirements of Transcontinental & Western Air, Inc. During its development, and after consultation with T.W.A., Pan American Airways also ordered a number of Constellations but on the entry of the United States into the war both companies waived their rights in favour of the Army Air Forces, to whose requirements the Constellation was completed and put into production as a military transport under the designation C-69.

The following were the designations of the various military versions of the Constellation:—

XC-69. Original Model 49 ordered by airlines and turned over to the U.S.A.A.F.

C-69A. Model 49 fitted to carry up to 100 troops. Cancelled.

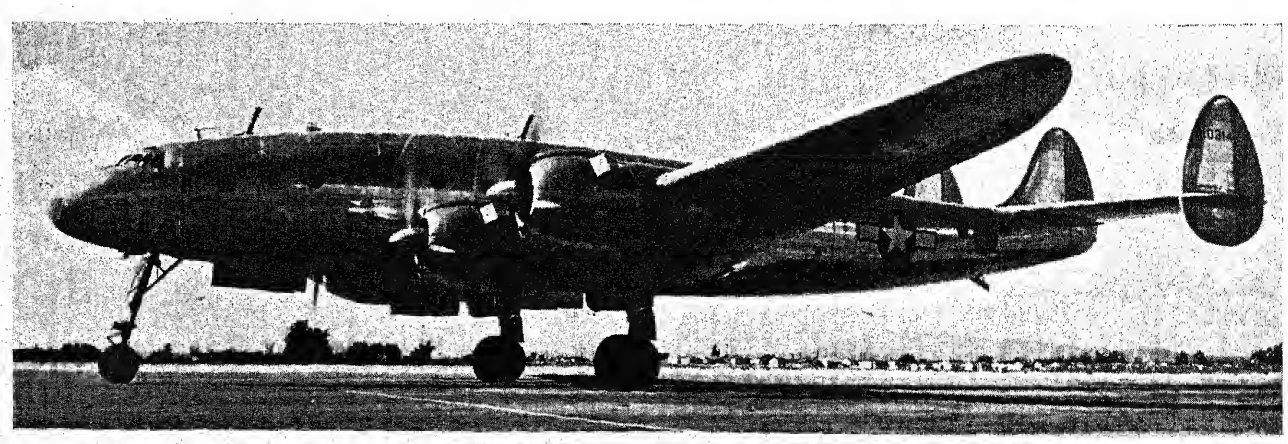
C-69B. Fitted to accommodate crew of six and 94 troops on benches. Cancelled.

C-69C. Personnel version to carry crew of six and 43 in chairs. One built, 49 cancelled on VJ-Day and modified by Lockheed for airline use.

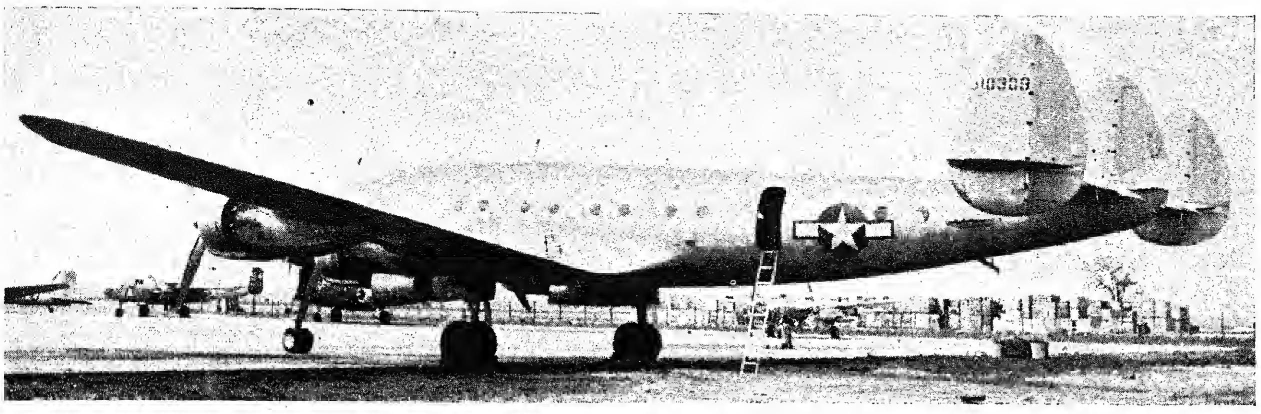
C-69D. Three cancelled by U.S.A.A.F. on VJ-Day and modified by Lockheed for delivery to airlines.

XC-69E. One Model 49 fitted with four Pratt & Whitney R-2800 engines in place of standard power plant of four Wright R-3350-35 engines.

When the war ended military contracts were cut and production was converted for civil purposes. The first delivery of a commercial Model 49 was made to T.W.A. on October 1, 1945, and the C.A.B. granted Airworthiness Type Certificate No. 763 for this type of aircraft on December 11, 1945. All the early deliveries of Constellations were conversions of aircraft begun as military C-69 transports.



The Lockheed Constellation in military guise. Most C-69 military transports have now been converted for commercial use.



The Lockheed XC-69E Constellation, an experimental model fitted with four Pratt & Whitney R-2800 engines.—(*Peter Bowers*).

Owing to several accidents which were at the time attributed to the engine installation the Airworthiness Certificate of the Model 49 was temporarily withdrawn on July 11, 1946, while direct-injection GR-3350 engines were substituted for the original power units, and other minor changes were made to the pressurization system. These modified aircraft are known as the Model 49-46.

The Constellation built throughout as a commercial aeroplane is known as the Model 649. This version is fitted with the slightly more powerful Wright GR-3350-BD1 engines with direct fuel-injection systems, is more luxuriously furnished, and has slightly greater maximum and cruising speeds.

The Model 749 is a long-range version which will be available for delivery in 1947. It will have new wings with additional fuel tankage, thermal de-icing, etc.

Constellations are operated, or have been ordered, by Pan American World Airways, T.W.A., American Overseas Airlines, Eastern Air Lines, Pan American-Grace Airways, British Overseas Airways, Qantas Empire Airways, Air France, K.L.M., K.N.I.L.M., Panair do Brasil and Aer Lingus Tta.

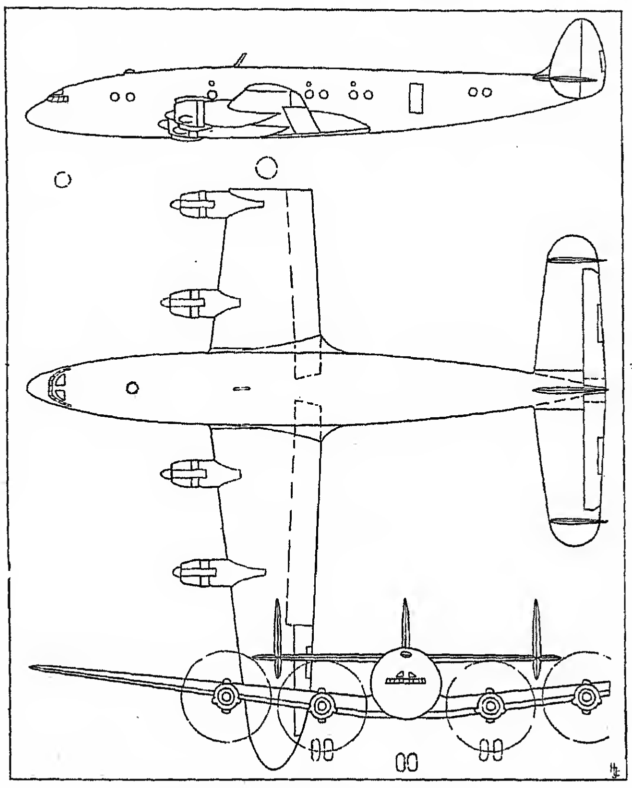
TYPE.—Four-engined Airliner.

WINGS.—Cantilever low-wing monoplane. All-metal structure in five main sections consisting of centre-section carrying engine nacelles, two outer wings and detachable tips. Two-spar structure with flush-riveted stressed metal skin. False spar carrying ailerons and flaps. Fabric-covered metal ailerons each have controllable trim-tab and hydraulic boost control. Lockheed-Fowler trailing-edge flaps extend from ailerons nearly to centre-line of fuselage Flap positions for take-off, landing and manoeuvring. Gross wing area 1,650 sq. ft. (153.5 sq. m.).

FUSELAGE.—All-metal semi-monocoque structure. Circular cross-section throughout length and with centre-line cambered to give longitudinal aerofoil section and maximum length and width of level floor, particularly in nose and tail sections. Structure consists of transversal frames and flush-riveted stressed metal skin.

TAIL UNIT.—Cantilever monoplane type consisting of tailplane and two-piece elevator mounted at top of fuselage, and two inset fins and rudders with third fin and rudder on fuselage centre-line. All-metal structure with stressed metal skin over fixed surfaces and fabric-covered rudders and elevators. Controllable trim-tabs in rudders and elevators. Hydraulically-boosted control surfaces with manual override control for auxiliary use. Tailplane span 50 ft. 0 in. (15.24 m.).

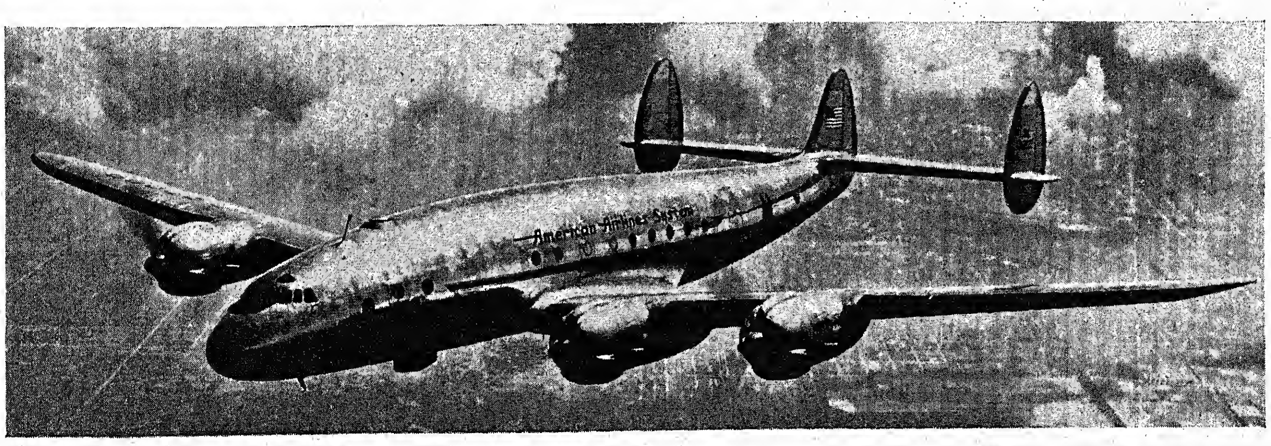
LANDING GEAR.—Retractable tricycle type with dual wheels on all units. Each main unit consists of twin wheels 17.00 × 20 carried on single shock-absorber strut with side and front link members which retract forward into inner engine nacelles and are fully enclosed by twin doors. Low pressure tyres. Track (centre-line of legs) 28 ft. 0 in. (8.50 m.). Nose-unit consists of steerable twin smooth-contour wheels 2 ft. 9 in. (0.84 m.) diameter, carried on single shock-absorber leg which retracts backwards into fuselage and is enclosed by twin doors and fairing plate attached to front of leg. Dual hydraulic brake system on main wheels with manual



The Lockheed Constellation Airliner.

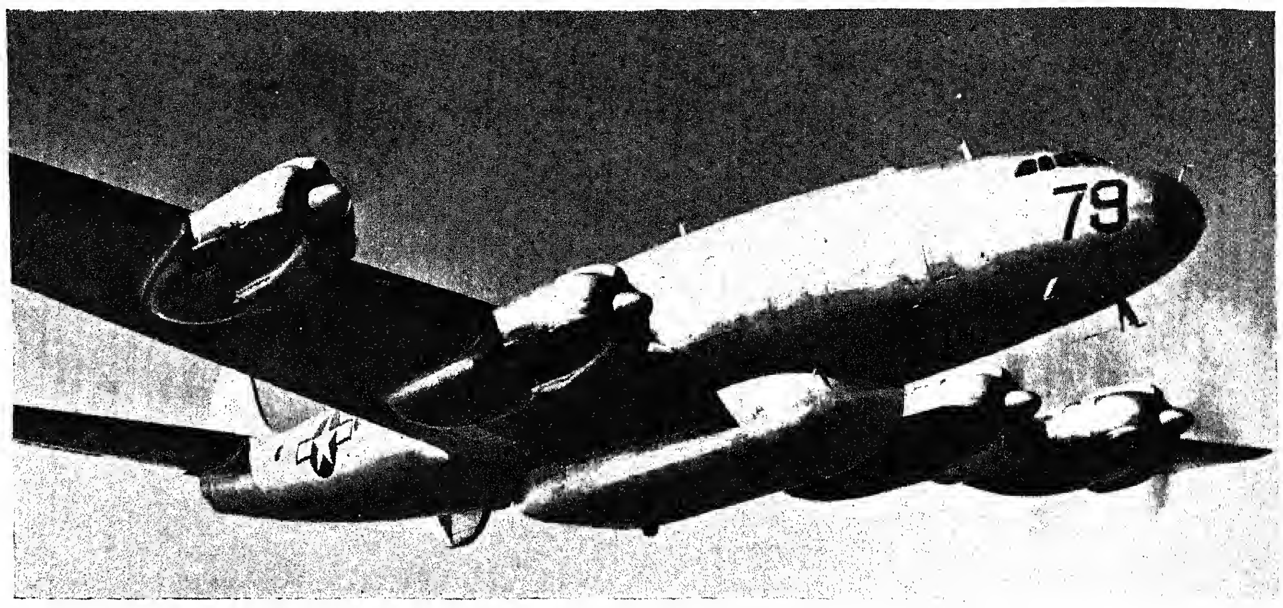
auxiliary override control. Emergency retractable bumper-skid below rear fuselage.

POWER PLANT.—Four Wright Cyclone GR-3350-BD1 eighteen-cylinder two-row radial air-cooled engines each rated at 2,500 h.p. for take-off and enclosed in long-chord tapered cowlings. Stainless-steel nacelles, with all ducting and controls grouped at fire-proof bulkhead, are completely detachable and can be changed in 30 minutes. Automatic fire-detection and location with positive fire-extinguisher system operated by flight engineer. Hamilton-Standard Hydromatic or Curtiss-Electric three-blade reversible



The Lockheed Model 49 Constellation Airliner (four Wright GR-3350-BD1 Cyclone engines).

***LOCKHEED**—continued.*



A Lockheed C-69 Constellation fitted with a "Speedpak" freight container.

airscrews, 15 ft. 2 in. (4.62 m.) diameter. Four separate fuel systems in wings with total capacity of 4,760 U.S. gallons (15,592 litres). Total oil capacity 186 U.S. gallons (702 litres) in four separate tanks.

ACCOMMODATION.—Pressurized cabin for crew and passengers maintains 8,000 ft. (2,440 m.) cabin atmosphere at 20,000 ft. (6,095 m.). Two fully-automatic cabin superchargers with manual override control. Thermostatically-controlled heating and cooling. Refrigeration unit cools cabin to 75 degrees Fahrenheit with outside temperature at 110 degrees Fahrenheit. Pilot's compartment in forward portion of fuselage with pilot (on port) and co-pilot side-by-side with dual controls. Electric windshield de-icers. Flight engineer behind co-pilot facing outboard. Radio-operator behind pilot facing forward. Steward and stewardess. Entry to crew compartment on starboard side. Aft of crew compartment is fully-insulated forward passenger cabin, followed by compartment which can be arranged as galley, buffet, lounge, etc. Next follows main passenger cabin, insulated against sound, vibration and outside temperature. Many alternative arrangements allow for total accommodation of from 44 to 60 passengers. 48-passenger version convertible to sleeper with 22 berths and 4 seats; 44-passenger version convertible to sleeper with 20 berths and 4 seats. Main entry door at rear on port. Aft of main cabin are lavatories, coatroom and mealtime accommodations. Two freight compartments with total capacity of 440 cub. ft. (12.45 cub. m.) below floor of main cabin with allowance for 5,850 lbs. (2,651 kg.), or 13,400 lbs. (6,077 kg.) with auxiliary flooring. Other freight stowage dependent on passenger accommodation. Additional freight, etc. can be carried in an all-metal pannier, known as a "Speedpak," 33 ft. long × 7 ft. wide × 3 ft. deep (10.05 × 2.13 × 0.9 m.) and weighing 1,700 lbs. (771 kg.). This is carried under and closely fits the contour of fuselage. The "Speedpak" has capacity of 395 cub. ft. (11.17 cub. m.) and a stowage allowance of 10,000 lbs. (4,536 kg.). Built-in electric hoist lowers "Speedpak" to ground for loading or unloading. "Speedpak" reduces speed by about 10 m.p.h. (16 km.h.).

DIMENSIONS.—Span 123 ft. 0 in. (37.49 m.), Length 95 ft. 1$\frac{3}{16}$ in. (28.97 m.), Height over fuselage 18 ft. 8$\frac{3}{16}$ in. (5.6 m.), Height overall 23 ft. 8 in. (7.2 m.).

WEIGHTS AND LOADINGS (Model 649).—Weight empty (including crew and all passenger equipment) 55,000—60,750 lbs. (24,924—27,556 kg.) depending on interior arrangements. Payload (approximate) 49,280 lbs. (22,353 kg.), Maximum take-off loaded weight 100,000 lbs. (45.359 kg.), Maximum landing weight 78,000 lbs. (35,381 kg.). Wing loading (at maximum take-off weight) 48.3 lbs./sq. ft. (235.8 kg./sq. m.), Power loading (at maximum take-off weight, take-off h.p.) 10 lbs./sq. ft. (4.5 kg./h.p.).

PERFORMANCE (Model 649).—Maximum speed (fully loaded) over 350 m.p.h. (563 km.h.), Maximum cruising speed at 60% power, over 300 m.p.h. (483 km.h.), Landing speed 80 m.p.h. (129 km.h.), Service ceiling 25,000 ft. (7,620 m.), Three-engine ceiling, over 20,000 ft. (6,095 m.), Two-engine ceiling over 8,000 ft. (2,440 m.), Normal range 3,000 miles (4,828 km.), Maximum range 5,000 miles (8,046 km.), Take-off run at sea level with full load, under 667 yds. (610 m.), Take-off distance to 50 ft. (15 m.) with full load, under 933 yds. (853 m.), Landing distance from 50 ft. (15 m.) at maximum landing weight, 833 yds. (762 m.).

THE LOCKHEED MODEL 26 NEPTUNE.

U.S. Navy designations : P2V-1 and P2V-2.

The P2V Neptune is in production for the U.S. Navy, the first delivery being made in December, 1945.

Between September 29 and October 1, 1946, a specially-modified P2V-1 set up a World's Record for Distance in a Straight Line by flying non-stop from Perth, Western Australia, to Columbus, Ohio, U.S.A., a distance of 11,250 miles (18,105 km.). Flight time was 55 hours 15 min. The crew consisted of Cdr. Thomas D. Davies, Cdr. Eugene P. Rankin, Cdr. Walter S. Reid, and Lt. Cdr. Roy H. Taberling, all U.S.N.

The aircraft took off at a loaded weight of 85,000 lbs. (38,600 kg.) of which 50,400 lbs. (22,890 kg.) was gasoline, the fuel load alone representing about one and a half times the empty weight of the aircraft. Jato was used for take-off.

TYPE.—Twin-engined Naval Patrol Bomber.

WINGS.—All-metal cantilever mid-wing monoplane consisting of constant-chord centre-section and two tapering outer wings.

The Lockheed Model 34 Little Dipper, a small single-seat light monoplane which was built before the Lockheed company abondoned its intention to enter the personal plane market.

***LOCKHEED**—continued.*

The Lockheed P2V-1 Neptune Naval Patrol Bomber (two 2,300 h.p. Wright R-3350-8 engines).

Metal covering. Gross wing area 1,000 sq. ft. (92.9 sq. m.). All-metal ailerons with controllable trim-tab in each. Aileron area (each) 66 sq. ft. (6.13 sq. m.). Improved-type Fowler split trailing-edge flaps between ailerons and fuselage, rear portion of each nacelle moving with inner flaps.

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type, with metal covering over all surfaces. "Varicam" tailplane adjustable for incidence. Balanced control surfaces, with trim-tab in each elevator, and trim and balance-tabs in rudder. Elevator area (each) 39.3 sq. ft. (3.65 sq. m.), Rudder area 38.4 sq. ft. (3.57 sq. m.).

LANDING GEAR.—Retractable tricycle type. Each main wheel 4 ft. 10 in. (1.47 m.) diameter, carried on outside of single shock-absorber leg with side and front link members, retracts forward into engine nacelle and is enclosed by twin doors. Nose-wheel 3 ft. 4 in. (1.01 m.) diameter retracts backwards into fuselage and is enclosed by twin doors. Hydraulic brakes on main wheels.

POWER PLANT.—Two Wright R-3350-8 (P2V-1) or R-3350-24W (P2V-2) eighteen-cylinder two-row radial air-cooled engines, the former rated at 2,300 h.p. for take-off and enclosed in long-chord cowlings with controllable cooling gills. Hamilton Standard Hydromatic four-blade constant-speed airscrews, 15 ft. 2 in. (4.62 m.) diameter. Self-sealing fuel-tanks with nylon plastic casing. Fuel capacity 2,350 U.S. gallons (8,896 litres). Dural armour in nacelles.

ACCOMMODATION.—Crew of seven: pilot, co-pilot, navigator/bombardier (who handles radar bombing gear), radar operator, and dorsal and rear gunners. All positions armoured. Galley and sleeping accommodation.

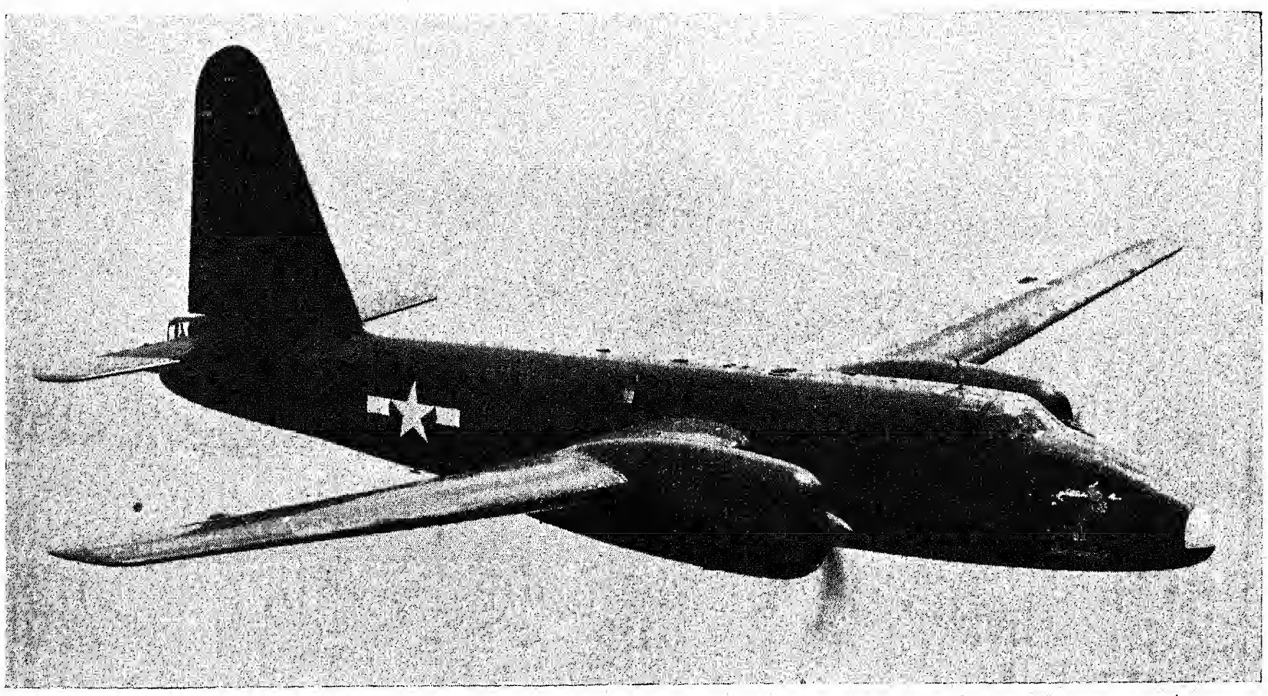
ARMAMENT.—Up to six 20 m/m. forward-firing cannon in nose; two .5-in. (12.7 m/m.) flexible machine-guns in dorsal turret; and two similar guns in power-operated tail turret. Provision for sixteen 5-in. (12.7 c/m.) rocket projectiles under wings. Bomb-load of 8,000 lbs. (3,629 kg.) carried internally may consist of sixteen 500 lbs. (227 kg.), eight 1,000 lbs. (454 kg.) or four 2,000 lbs. (907 kg.) bombs, two 2,165 lbs. (982 kg.) torpedoes or twelve 325 lbs. (147 kg.) depth-charges, or 2,000 lbs. (907 kg.) sea-mines.

EQUIPMENT.—Full radio, navigation, radar and photographic equipment.

DIMENSIONS.—Span 100 ft. 0 in. (30.48 m.), Length 75 ft. 6 in. (23.0 m.), Height (over rudder) 28 ft. 1 in. (8.5 m.).

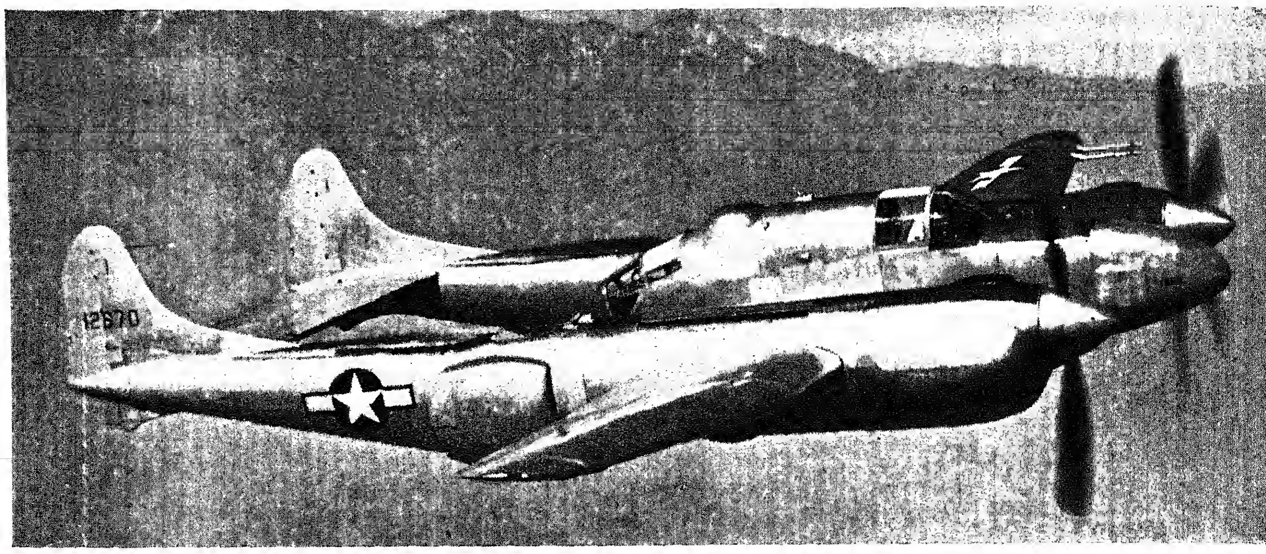
WEIGHTS AND LOADINGS.— Weight empty 32,957 lbs. (14,949 kg.), maximum loaded take-off weight 58,000 lbs. (26,288 kg.), Wing loading 58 lbs./sq. ft. (283 kg./sq. m.), Power loading (at maximum overload) 16.1 lbs./h.p. (7.25 kg./h.p.).

PERFORMANCE.—Maximum speed, over 300 m.p.h. (483 km.h.), Cruising speed 170 m.p.h. (274 km.h.), Stalling speed at 45,000 lbs. (20,410 kg.) 78 m.p.h. (125 km.h.), Service ceiling 23,200 ft. (7,070 m.), normal range, over 3,500 miles (5,632 km.), Ferrying range with extra tanks in bomb-bay 5,000 miles (8,046 km.), Take-off run 466 yds. (426 m.), Landing run 467 yds. (427 m.).



The Special Lockheed P2V Neptune "Truculent Turtle" which holds the World's Distance Record with a non-stop flight of 11,250 miles.

LOCKHEED—*continued.*



The Lockheed XP-58 Experimental Two-seat Escort Fighter (two Allison V-3420-11/13 engines).

THE LOCKHEED MODEL 23.

U.S. Army Air Forces designation : XP-58.

The XP-58 was an experimental escort fighter and shipping destroyer which was developed in 1940. Following the twin-fuselage formula, the XP-58 was about one-third larger than the P-38 and carried a crew of two and a heavy armament.

The nose armament normally consisted of four 37 m/m. high-velocity cannon under the control of the pilot. An interchangeable nose with a single 75 m/m. cannon could be substituted for the normal installation.

The rear armament was mounted in two turrets, one above and one below the fuselage and each mounting two .5 in. (12.7 m/m.) machine-guns. These turrets were remotely-controlled by the rear gunner located in the after end of the central nacelle. This installation represented one of the first experiments on central fire control ever made.

The XP-58 was originally intended to be fitted with two Wright R-2160 Tornado forty-two-cylinder seven-bank liquid-cooled engines driving oppositely-rotating airscrews but this engine was abandoned during development. The only XP-58 built was fitted with two Allison V-3420-11/13 twenty-four-cylinder double-Vee power units.

The XP-58 had a maximum loaded weight of 38,000 lbs. (17,250 kg.), more than twice that of the P-38. The wing span was 70 ft. (21.35 m.) and the overall length 49 ft. 6 in. (22.5 m.).

THE LOCKHEED MODEL 22 LIGHTNING.

U.S. Army Air Forces designation: P-38 and F-5.

The P-38 Lightning was the only American fighter built before the war to be still in production on VJ-Day. Developed through eighteen successively-improved versions, the Lightning was used in all U.S. combat zones as a high and low altitude fighter, fighter escort, bomber, photographic-reconnaissance aircraft, low attack and rocket fighter and smoke-screen layer.

The first military aeroplane developed by Lockheed, the P-38 was designed to meet an Air Corps specification issued in 1936. The XP-38 prototype first flew on January 27, 1939, and the first YP-38 aircraft of a limited procurement order for thirteen was delivered to the Army in March, 1941.

The P-38D was the first version of the Lightning to go into service in the war—an aircraft of this mark was the first American fighter to shoot down an enemy aeroplane over Iceland a few minutes after the United States declared war on Germany. The P-38L Lightning, the last fighter version to see combat service, took part in the final stages of the Pacific war and two Lightnings escorting a Boeing Fortress were actually the first Allied fighters to land on Japanese soil after the surrender.

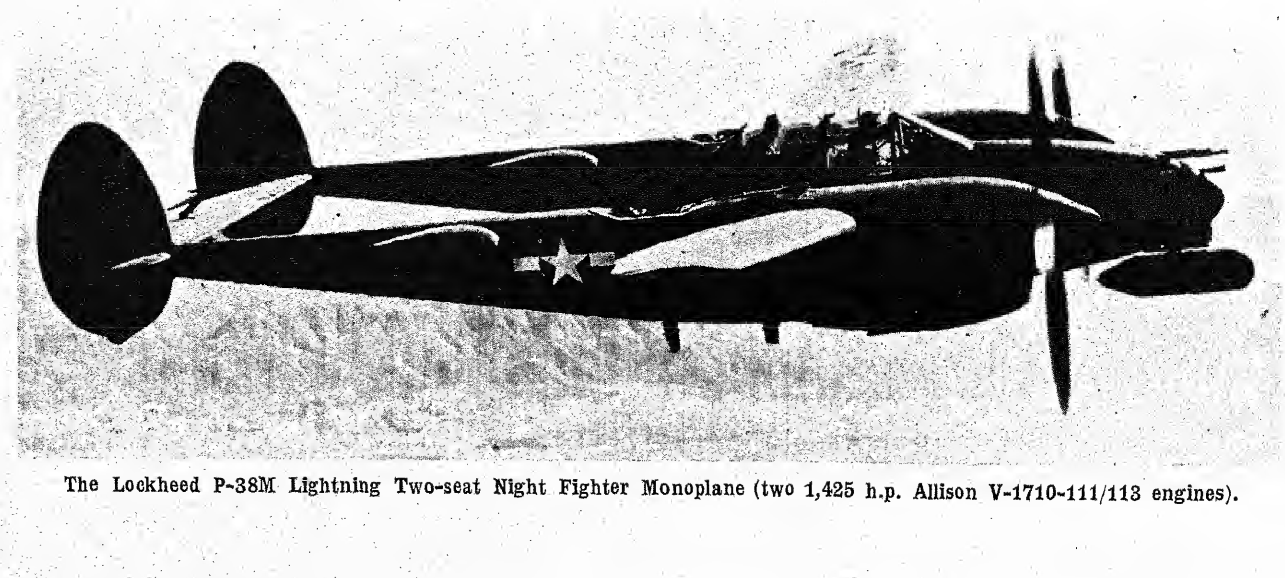
The development of the Lightning, with details of all marks up to the P-38L and F-5B, was fully outlined in the last issue of "All the World's Aircraft." Since then brief details and photographs have been released concerning the P-38M and F-5G both of which saw service in the Pacific during the last few weeks of the war.

The P-38M was a two-seat night fighter which differed from the P-38L in having an additional cockpit for a radar operator immediately behind the pilot's cockpit. Radar equipment was carried in a streamlined carrier under the nose. Armament was similar to that of the P-38L. Long-range fuel tanks or two 1,000 lb. (454 kg.) bombs could be carried under the inner wings, and standard rocket cluster launchers under the outer wings.

The F-5G was the last photographic-reconnaissance version of the Lightning. It was fitted with a new type of elongated nose in which were installed five cameras. This nose was interchangeable with the standard P-38L multi-gun nose.

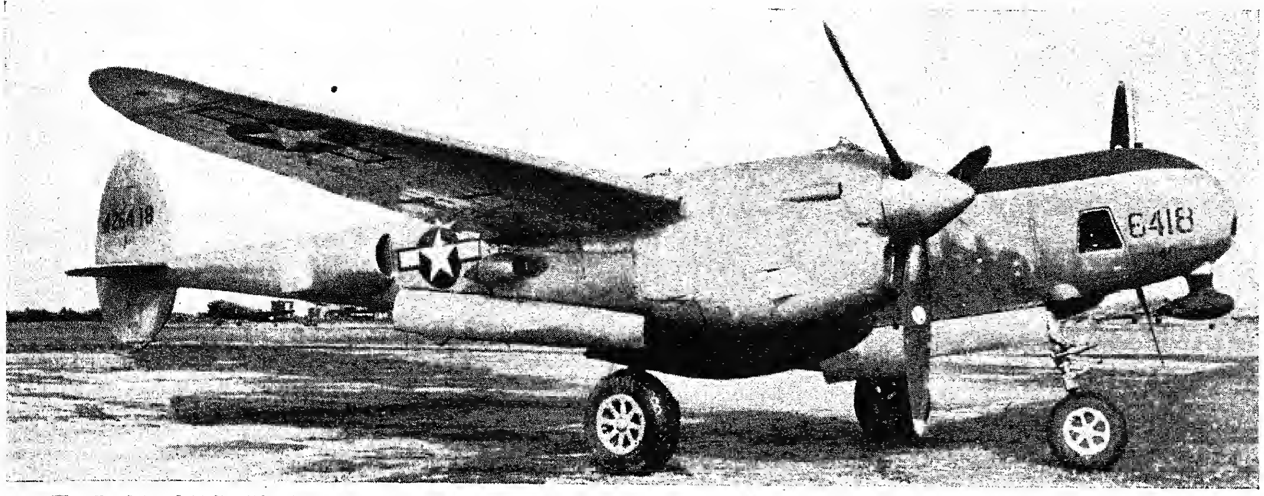
The Lightning was withdrawn from production within a few days of VJ-Day after 9,923 had been delivered to the U.S. Army. The P-38L was at the time of writing still in service in the U.S. Army Air Forces at home and with the occupation forces overseas.

A special version of the P-38, called unofficially the "Lightning Swordfish," was produced in 1943 and used by Lockheed research engineers to test the drag, lift and airflow characteristics of new aerofoil sections. A special section was built on to the wing outboard of the engines as shown in the accompanying photograph, and various instruments were carried for obtaining

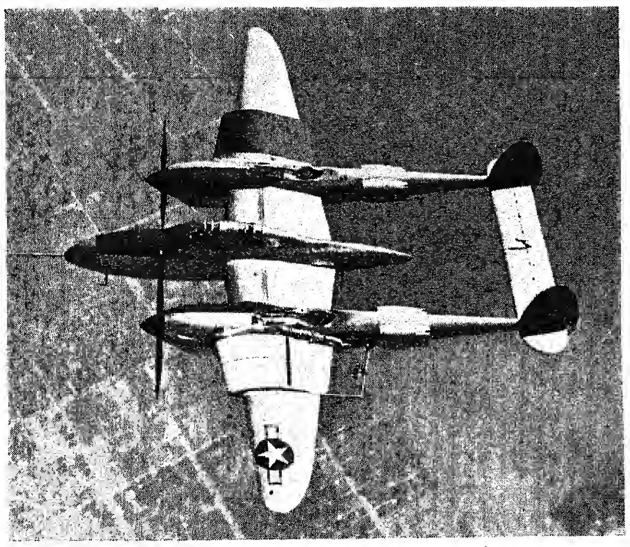


The Lockheed P-38M Lightning Two-seat Night Fighter Monoplane (two 1,425 h.p. Allison V-1710-111/113 engines).

LOCKHEED—*continued.*



The Lockheed F-5G Lightning Single-seat Photographic-Reconnaissance Monoplane (two Allison V-1710 111/113 engines).—
(*Peter Bowers*).



The Lockheed "Lightning Swordfish" used for research purposes.

aerodynamic data. A second cockpit was installed behind the pilot so that an observer could be carried, and the nacelle was extended aft of the wing trailing-edge. Aerofoil sections were tested at dive speeds of over 525 m.p.h. (845 km.h.) with this aircraft.

A full structural description of the Lightning was published in the last issue of this Annual. The following figures relate to the P-38L fitted with two 1,425 h.p. Allison V-1710-111/113 engines :—

DIMENSIONS.—Span 52 ft. (15.8 m.), Length 37 ft. 10 in. (11.53 m.), Height 12 ft. 10 in. (3.9 m.).

WEIGHTS.—Weight empty (with equipment) 14,100 lbs. (6,405 kg.), Normal loaded combat weight 17,500 lbs. (7,945 kg.), Maximum permissible loaded weight 22,000 lbs. (9,978 kg.).

PERFORMANCE.—Maximum speed 414 m.p.h. (662 km.h.) at 25,000 ft. (7,620 m.), Speed at 30,000 ft. (9,145 m.) 405 m.p.h. (648 km.h.), Rate of climb at 5,000 ft. (1,525 m.), 3,670 ft./min. (1,120 m./min.), Rate of climb at 10,000 ft. (3,050 m.) 3,525 ft./min. (1,075 m./min.), Rate of climb at 20,000 ft. (6,095 m.) 2,925 ft./min. (892 m./min.), Rate of climb at 25,000 ft. (7,625 m.) 2,415 ft./min. (736 m./min.), Service ceiling over 35,000 ft. (10,680 m.), Range (Fighter with normal fuel) 460 miles (736 km.), Range (with maximum fuel) 2,260 miles (3,620 km.).

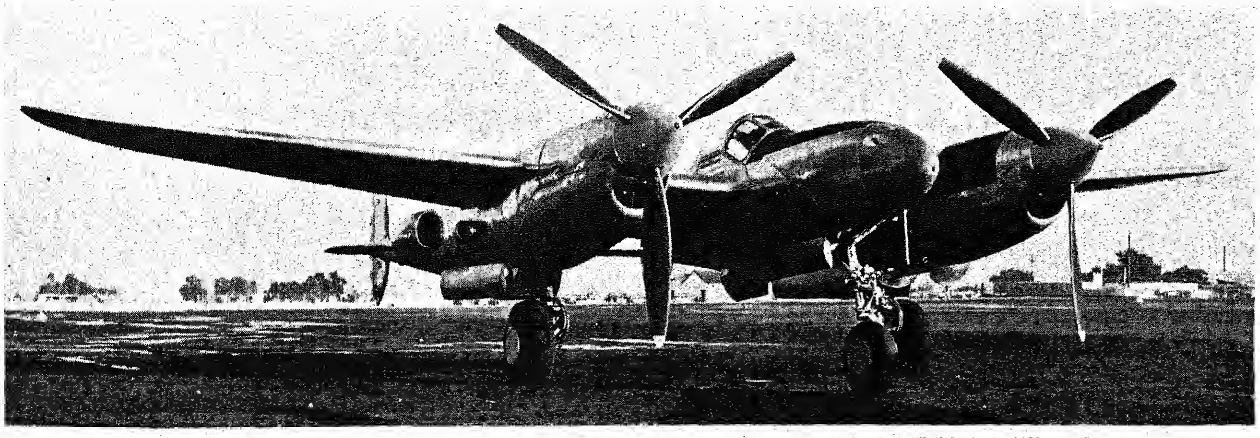
THE LOCKHEED MODEL 20.

U.S. Army Air Forces designation : XP-49.

The XP-49 was a modification of the P-38 fitted with two 1,990 h.p. Continental V-1430-13/15 Vee liquid-cooled engines. It was the fastest, heaviest and most powerful version of the Lightning ever built.

The XP-49, which was fitted with a pressure cabin, was used for high-altitude research to test equipment later incorporated in the P-80.

The new engine installation added about 3 ft. 6 in. (1.06 m.) to the length of the P-38. The loaded weight of the XP-49 was 18,830 lbs. (8,550 kg.) and its maximum speed 458 m.p.h. (733 km.h.).



The Lockheed XP-49 Experimental High-Altitude Monoplane (two Continental V-1430-13/15 engines).

LUSCOMBE.

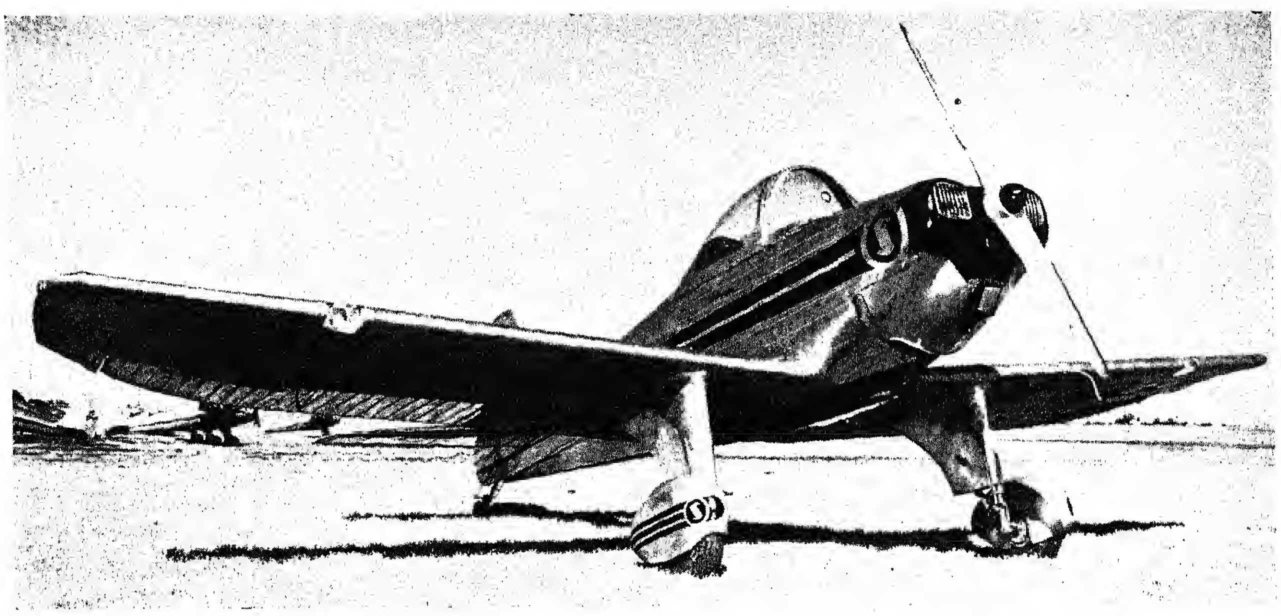
LUSCOMBE AIRPLANE CORPORATION.

HEAD OFFICE AND WORKS : P.O. Box 2128, DALLAS 1, TEXAS.
President : Leopold H. P. Klotz.
Vice-President in charge of Production : James P. Cunningham.
Secretary and Treasurer : Donald S. Grubbs.

The Luscombe Airplane Corporation pioneered the development of die-cut metal construction and worked out methods that made this type of production with interchangeable parts a reality.

It produced its first all-metal aeroplane in 1934 and in 1937 introduced the first of the Silvaire series of light two-seat all-metal cabin monoplanes. Production of the Silvaire ceased shortly after America's entry into the War owing to priority

LUSCOMBE—*continued.*



The Luscombe Model 10 Single-seat Monoplane (65 h.p. Continental engine).

restrictions on the use of metal for non-military aircraft, after about 1,200 had been built.

The company's plant was enlarged and converted for the production of metal parts and assemblies for several types of American combat aircraft, on which work it was wholly engaged from 1942 until the end of the war.

Immediately after VJ-Day the Luscombe company resumed production of the Silvaire at its new Dallas factory. Production is centred on the 85 h.p. Model 8E, while the 65 h.p. Model 8A is still being produced.

Also under development is a single-seat low-wing monoplane known as the Model 10. This aircraft, which was, at the time of writing, still in the experimental stage, makes use of a number of standard Silvaire components. A brief description follows.

THE LUSCOMBE MODEL 10.

The Model 10 is a single-seat enclosed low-wing cantilever monoplane employing the characteristic Luscombe engineering methods, and does in fact incorporate certain Silvaire parts. It is of all-metal construction except for the fabric-covered wing, has an aluminium monocoque fuselage, and is powered by a 65 h.p. Continental four-cylinder horizontally-opposed air-cooled engine driving a Sensenich two-blade wooden airscrew. This aircraft is still in the experimental stage, and the following data apply to the prototype.

DIMENSIONS.—Span 25 ft. 0 in. (7.62 m.), Length 17 ft. 0 in. (5.18 m.).

WEIGHT LOADED.—845 lbs. (383 kg.).

PERFORMANCE.—Maximum speed, over 135 m.p.h. (217 km.h.), Cruising speed 122 m.p.h. (196 km.h.), Fuel consumption (at cruising speed) 4 U.S. gallons p.h. (15 litres p.h.).

THE LUSCOMBE MODEL 8E SILVAIRE.

TYPE.—Two-seat all-metal cabin monoplane.

WINGS.—Strut-braced high-wing monoplane. Wings attached to top sides of cabin and braced by single non-welded struts. Structure consists of two I-type spars of extruded duralumin, two chordal ribs and Alclad skin. Detachable wing-tips. Wing area 140 sq. ft. (13 sq. m.). Ailerons covered with beaded Alclad sheet riveted to a single duralumin spar.

FUSELAGE.—Monocoque structure using curved Alclad pre-drilled sheets riveted to oval duralumin bulkhead stampings. Wing struts and landing-gear attached to aluminium forgings riveted to forward section of metal seat bottom on either side. Standard size pre-drilled skin sections are easily replaceable.

TAIL UNIT.—Cantilever monoplane type. Duralumin spars and ribs with Alclad sheet covering. Tip sections of tailplane and fin are interchangeable. Fixed surfaces bolted to rear of fuselage. Vernier elevator trim-tabs.

LANDING GEAR.—Divided type. Heat-treated steel-tube legs and struts. Main legs hinged at sides of fuselage with springing by single oleo-spring unit mounted within fuselage. Full-swivelling steerable tailwheel. Wheels may be replaced by twin Edo floats.

POWER PLANT.—One 85 h.p. Continental C85-12 four-cylinder horizontally-opposed air-cooled engine driving a Sensenich two-blade wooden airscrew. Fuel capacity 30 U.S. gallons (114 litres).

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. One-piece Plexiglas windscreen. Large door on each side. Side panels hinged at top and open outwards. Baggage compartment behind seats. Allowance 75 lbs. (34 kg.).

DIMENSIONS.—Span 35 ft. (10.7 m.), Length 20 ft. (6.1 m.), Height 5 ft. 10 in. (1.78 m.).

The Luscombe Model 8E Silvaire Two-seat Cabin Monoplane (85 h.p. Continental C85 engine).

***LUSCOMBE**—continued.*

The Luscombe Model 8A Silvaire Two-seat Cabin Monoplane (65 h.p. Continental A65 engine).

WEIGHTS AND LOADINGS.—Useful load 550 lbs. (249 kg.), Weight loaded 1,400 lbs. (635 kg.), Wing loading 10 lbs./sq. ft. (48.83 kg./sq. m.), Power loading 16.4 lbs./h.p. (7.43 kg./h.p.).

PERFORMANCE.—Maximum speed 125 m.p.h. (201 km.h.), Cruising speed 112 m.p.h. (180 km.h.), Landing speed 48 m.p.h. (77 km.h.), Rate of climb 800 ft./min. (244 m./min.), Service ceiling 16,500 ft. (5,030 m.), Cruising range 600 miles (966 km.).

THE LUSCOMBE MODEL 8A SILVAIRE.

The Model 8A Silvaire, powered by a 65 h.p. Continental A65-8 four-cylinder horizontally-opposed air-cooled engine, is still in production, and is the basic type from which the Model 8E was developed. In general appearance the two models are identical but the Model 8A has an orthodox two-spar metal wing braced by steel-tube V-struts. There is fuel capacity for 14 U.S. gallons (53 litres), and the baggage allowance is 50 lbs. (23 kg.).

DIMENSIONS.—As Model 8E.

WEIGHTS AND LOADINGS.—Weight empty 720 lbs. (327 kg.), Useful load 540 lbs. (245 kg.), Weight loaded 1,260 lbs. (572 kg.), Wing loading (fully loaded) 9 lbs./sq. ft. (43.94 kg./sq. m.), Power loading (fully loaded) 19.38 lbs./h.p. (8.79 kg./h.p.).

PERFORMANCE.—Maximum speed 115 m.p.h. (185 km.h.), Cruising speed 105 m.p.h. (169 km.h.), Landing speed 37 m.p.h. (60 km.h.), Maximum diving speed 145 m.p.h. (233 km.h.), Rate of climb 900 ft./min. (274 m./min.), Service ceiling 15,000 ft. (4,570 m.), Absolute ceiling 17,000 ft. (5,180 m.), Take-off run (at sea level, fully loaded) 550 yds. (503 m.), Landing run (at sea level, fully loaded) 500 yds. (457 m.).

McFARLAND.

McFARLAND AIRCRAFT COMPANY.

HEAD OFFICE AND WORKS: GREENVILLE, OHIO.
SAILPLANE DIVISION: SPRING VALLEY, CALIFORNIA.
President and Treasurer: Walter D. McFarland.
Vice-President and Chief Design Engineer, Sailplane Division: James B. Neiswonger.
Chief Design Engineer (Greenville): Karl Eshelman.
Executive Secretary: Lee Roy McFarland.

This company was founded under the name Neiswonger-McFarland Aeronautical Co., in May, 1934, but in October of that year the name was changed to McFarland Aircraft Company. In December, 1943, the Sailplane Division of the company was established in Spring Valley, Cal.

From its inception the company's activities have been devoted mainly to the research, development, design, production and marketing of aircraft for the private market, specialising for the most part in training gliders and sailplanes and, more recently, in the production of primary training glider construction kits.

The Sailplane Division has for several years concentrated on the development of the single-seat high-performance advanced training sailplane.

McDONNELL.

McDONNELL AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: ST. LOUIS 21, MO.
President: James S. McDonnell.
Vice-Presidents: Gardner W. Carr and C. W. Drake.
Chief Engineer: Garrett C. Covington.
Secretary: R. H. Charles.
Treasurer: P. M. Cozad.

The McDonnell Aircraft Corpn. was incorporated on July 6, 1939, to undertake the manufacture of military aircraft and aircraft parts.

During the war the McDonnell Aircraft Corpn. was engaged in the production of complete aircraft under primary production and experimental contracts with the U.S. Government, and parts and sub-assemblies for other aircraft manufacturers. It was also engaged in the production and use of plastics in aircraft manufacture.

Complete aircraft produced by the company included one experimental XP-67 twin-engined fighter; thirty Fairchild AT-21 bomber trainers; twenty-one KSD-1 guided missiles; twelve KDD-1 target drones; and two XFD-1 jet propelled naval fighters. Engineering and research services were also undertaken in connection with a number of standard service types. Parts and sub-assemblies manufactured represented approximately 7 million pounds in airframe weight.

In 1946 the company was engaged in series production of the FD-1 jet-propelled fighter for the U.S. Navy; was continuing the production of guided missiles and pilotless target drones, also for the U.S. Navy; and was engaged in a comprehensive helicopter development programme. Other work of a confidential nature was also in hand for the U.S. Government. Aircraft under development, concerning which no information was available for publication at the time of closing for press, include the XF2D-1 Naval fighter and the XP-88 and XP-85 Army fighters.

The first McDonnell helicopter, the Whirlaway or XHJD-1, flew for the first time in 1946. Brief details of this craft are given herewith.

THE McDONNELL XP-85.

The XP-85 is a small fighter monoplane to be fitted with a Westinghouse 24C axial-flow jet engine which is being developed for use as a "parasite" fighter to be carried as part of the defence of the Consolidated-Vultee B-36 six-engined bomber. It will be carried under the fuselage of the bomber and be fitted with quick-release and hook-on equipment. No further details are available for publication.

THE McDONNELL XP-88.

The XP-88 is a jet-propelled fighter monoplane which is under development for the U.S.A.A.F. It is reported to have a designed speed of 660 m.p.h. (1,056 km.h.) and to have a maximum range of 2,300 miles (3,680 km.). No further details available for publication.

THE McDONNELL WHIRLAWAY.

U.S. Navy designation: XHJD-1.

The XHJD-1 is a twin-engined twin-rotor helicopter which has been built to the order of the U.S. Navy Bureau of Aeronautics for helicopter flight research.

The craft, with a capacity for a crew of two and ten passengers, is fitted with two 450 h.p. Pratt & Whitney R-985 engines which are mounted in fore-and-aft "barrel" nacelles at the extremities of two rigidly-braced stub wings, one on each side of the fuselage. Two 40 ft. two-blade oppositely-rotating rotors are mounted on inclined pylons which spring from the outer sides of the engine nacelles, the overall span from rotor tip to rotor tip being 81 ft. (24.7 m.). Later it is intended to install two 46 ft. rotors with slight intermesh, which will give an overall span of 87 ft. (26.5 m.). Either engine will drive both rotors through a system of overrunning clutches.

A normal fuselage carries a vertical tail fin but no horizontal surfaces or anti-torque rotor are fitted. The wide-track landing-gear is of the conventional type with the main wheels sprung by vertical oleo legs attached to the stub wings just inboard of the engine nacelles and braced to the fuselage by horizontal members. A normal tail-skid is used.

The XHJD-1 cruises at over 100 m.p.h. (160 km.h.) with a useful load of 4,000 lbs. (1,820 kg.).

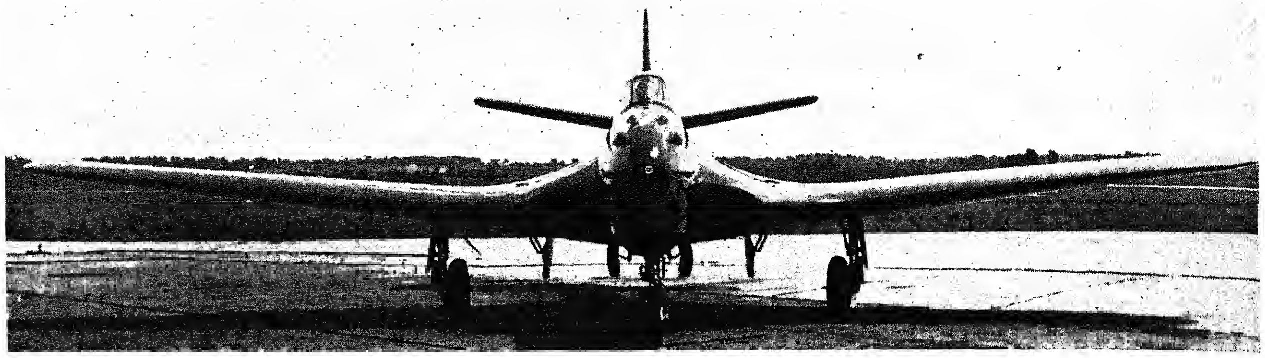
THE McDONNELL PHANTOM.

U.S. Navy designation: FD-1.

TYPE.—Single-seat Jet-propelled Fighter.

WINGS.—Cantilever low-wing monoplane. Laminar flow aerofoil section. Aluminium-alloy structure with flush-riveted and high-gloss finish, in three main sections, consisting of centre-section

***McDONNELL**—continued.*



The McDonnell FD-1 Phantom Single-seat Fighter (two Westinghouse 19B turbo-jet units).

and two outer sections, the latter folding upwards for carrier stowage. Hydraulic folding gear controlled from cockpit. All-metal ailerons with trim and balance tabs in each. Electrically-operated split trailing-edge flaps in four sections extend under fuselage between ailerons.

Fuselage.—Monocoque structure of aluminium-alloy with flush-riveted metal skin.

Tail Unit.—Monoplane type. Cantilever fin and dihedral tailplane. All-metal statically-balanced rudder and elevators, with controllable trim-tabs.

Landing Gear.—Retractable tricycle type. Main wheels carried on compression legs attached to extremities of centre-section retract inwards into wing. Nose-wheel carried on half-fork retracts backwards into fuselage below pilot's cockpit. All wing apertures completely covered by fairing plates and doors when landing-gear retracted. Deck arrester hook below rear fuselage.

Power Plant.—Two Westinghouse 19B Yankee axial-flow turbo-jet units mounted in wing-roots alongside the fuselage and exhausting aft of the trailing-edge of the wing. Air intakes in leading-edge of centre-section. Provision for JATO or catapult launch and for long-range drop-tanks.

Accommodation.—Pilot's cockpit has fixed forward portion with bullet-proof panel, and free-blown Plexiglas bubble canopy slides backwards for access.

Armament.—Four .5 in. (12.7 m/m.) machine-guns mounted in nose. Eight zero-length rocket launchers may be fitted under wings.

Dimensions.—Span 42 ft. 0 in. (12.80 m.), Width folded 16 ft. 0 in. (4.88 m.), Length 37 ft. 3 in. (11.35 m.).

Loaded Weight.—Under 10,000 lbs. (4,536 kg.).

Performance.—Maximum speed, over 500 m.p.h. (805 km.h.), Ceiling approximately 37,000 ft. (9,445 m.), Range (approximately) 1,000 miles (1,609 km.).

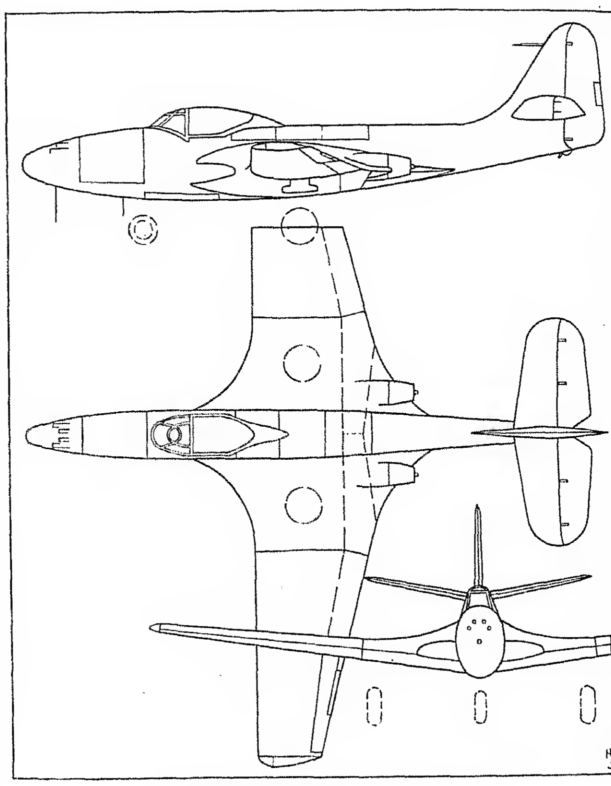
THE McDONNELL KADYDID.

U.S. Navy designation : KDD-1 (formerly TD2D-1).

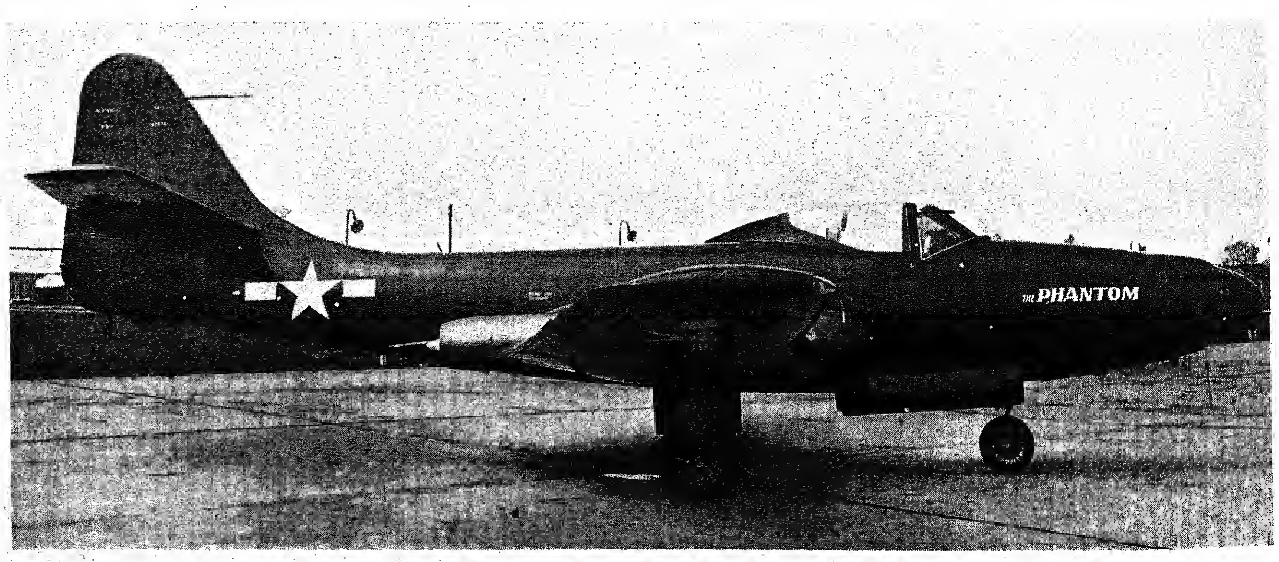
The KDD-1 is a pilotless radio-controlled target aircraft, or "Drone," which is used for training in anti-aircraft and air-to-air gunnery practice. It was developed by the McDonnell Aircraft Corpn. in conjuction with the U.S. Navy Bureau of Aeronautics.

The KDD-1 is powered by a McDonnell resonating jet engine of the type used in the German flying-bomb. It produces roughly the equivalent of 45 h.p. at the speeds at which the target is operated.

The general arrangement of the KDD-1 may be seen from the illustration on the next page. It is normally carried on the standard bomb-racks of a PBY Catalina flying-boat which conveys the drone to the target area at sea for release. After release, the target carrier becomes the target control aircraft. The Vee-type tail-unit was chosen to provide clearance under the carrier wing and to simplifiy the power-plant arrangements.

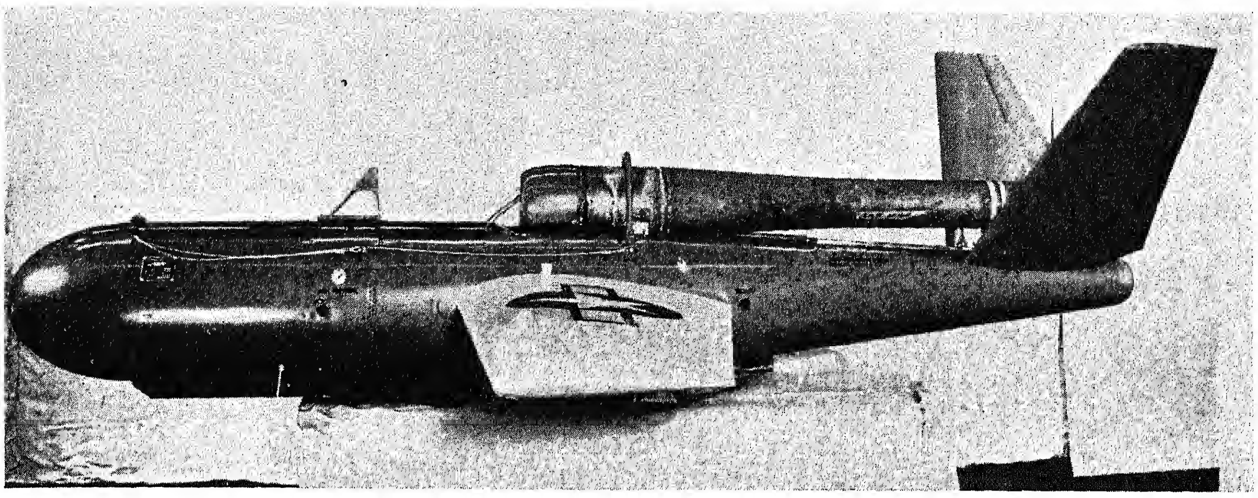


The McDonnell FD-1 Phantom.



The McDonnell FD-1 Phantom Single-seat Fighter (two Westinghouse 19B turbo-jet units).

McDONNELL—*continued.*



The McDonnell KDD-1 Kadydid Pilotless Radio-Controlled Target Drone.

The KDD-1 is provided with a parachute packed in a forward compartment, which can be released by radio signal. When the parachute is released the jet engine is automatically turned off and the drone floats down to be recovered for future use.

The speed in level flight is over 200 m.p.h. (320 km.h.) and this can be increased at the expense of range and endurance. The normal air endurance is about 40 minutes and by remote radio control the drone can be made to perform all manoeuvres normally performed by fighter aircraft. Production is continuing.

DIMENSIONS.—Span 12 ft. 2.6 in. (3.74 m.), Length 11 ft. 1 in. (3.38 m.).

THE McDONNELL GARGOYLE.

U.S. Navy designation: KSD-1 (formerly LBD-1).

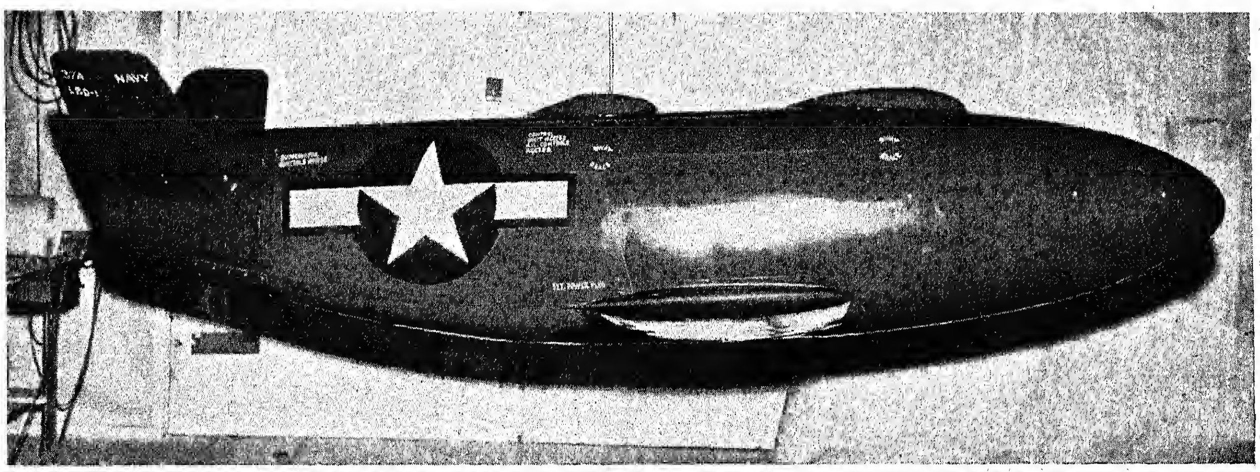
The KSD-1 is a rocket-propelled radio-controlled glider bomb, which was developed by the McDonnell Corporation in conjunction with the U.S. Navy Bureau of Aeronautics.

The bomb is carried by an aircraft and on release the rocket motor is fired to speed the missile up to the velocity required ahead of the control aircraft. A flare in the tail of the bomb provides the necessary visual contact. The flight of the bomb is stabilised by a system of gyroscopes and the control pilot, by radio, changes the setting of these gyroscopes to effect changes in the course required to hit the target.

The structure of the Gargoyle was designed to withstand extremely high speeds and the loads imposed by manœuvring at these speeds. It can carry either a general-purpose or a semi-armour-piercing head to provide for flexibility in use against various targets.

The Vee-tail provides both directional and altitude control, both surfaces operating together for altitude or pitch control, or differentially for directional control. The Vee-tail was adopted to enable the Gargoyle to be coupled up close under the wing and fuselage of the carrier aircraft.

DIMENSIONS.—Span 8 ft. 6 in. (2.59 m.), Length 10 ft. 1½ in. (3.5 m.).



The McDonnell KSD-1 Gargoyle Rocket-propelled Radio-controlled Glider-bomb.

MARTIN.

THE GLENN L. MARTIN COMPANY.

HEAD OFFICE AND WORKS: MIDDLE RIVER, BALTIMORE, MD.
Established: 1909.
President: Glenn L. Martin.
First Vice-President: H. T. Rowland.
Vice-President in charge of Manufacturing: G. T. Willey.
Vice-President in charge of Engineering: William K. Ebel.
Secretary: T. H. Jones.
Treasurer: M. G. Shook.

When the war ended the Glenn L. Martin Company was engaged in the production of PBM Mariner and JRM Mars flying-boats at its Baltimore plants, and the B-29 Superfortress at a Government-built bomber assembly plant at Omaha, Nebraska. It was also engaged on a number of important experimental projects.

Following VJ-Day, Government contracts for aircraft, spares parts, etc. with an aggregate value of $464,000,000 were cancelled. B-29 production ceased and the Omaha plant was closed down. Martin-built B-29s dropped the first atomic bombs on Hiroshima and Nagasaki and the special equipment needed to carry and release the bombs were designed and built at Omaha. In all, 536 Superfortresses was built by Martin.

The PBM and JRM contracts were drastically reduced, the latter from twenty to six. The last of the six Mars flying-boats differs from the previous five by having four Pratt & Whitney R-4360 engines and is known as the JRM-2. It was due for completion late in 1946. Production of the PBM-5 and development of the XPBM-5A amphibian has continued. The latter made its first flight on December 10, 1945, and it has since passed all its naval trials.

The company was also tooling up for the production of the BTM-1 dive-bomber and torpedo carrier which was specially designed for service in the *Midway* class of aircraft-carrier. This contract was also reduced after VJ-Day but production is now going ahead rapidly on the AM-1 Mauler, as the aircraft has been redesignated and named.

Less than a month after VJ-Day the Martin company announced its entry into the twin-engined commercial transport field with the Martin Model 202 and 303 40-passenger airliners, the latter featuring a pressurised cabin. Later the Model 304 with gas-turbine-driven airscrew power-plants was announced. By July, 1946, orders for 168 Model 202 and 159 Model 303 airliners had been received from U.S. domestic and foreign air transport companies. Deliveries of these aircraft will begin in

***MARTIN**—continued.*

1947. In the meantime, the company has been engaged in the conversion of military C-54 transports for commercial use by more than a dozen airline companies.

The Martin company has entered the helicopter field with the purchase of the assets and patents of Rotawings, Inc .of Philadelphia and a special divison for research and experiment with helicopter control systems, rotor hubs and blades has been established.

Development and research in the fields of electronics and jet-propulsion continues. Much work is being done in both directions, the electronics research being principally on radar to be used for guided missiles and pilotless aircraft. Jet-propulsion research is now the work of a separate division within the Engineering Department of the company.

THE MARTIN XB-48.

The XB-48 is an experimental six-jet Heavy Bomber which is being developed for the U.S.A.A.F. No details are available.

THE MARTIN XP4M-1.

The Martin XP4M-1 is a long-range naval patrol bomber with a combined power plant of reciprocating engines and turbo-jets. It is a cantilever shoulder-wing monoplane with a single fin and rudder and a dihedral tailplane. Each engine nacelle contains one Pratt & Whitney R-4360-4 Wasp-Major twenty-eight-cylinder four-row radial air-cooled engine driving a tractor airscrew, and one General Electric I-40 jet unit housed in the rear of the nacelle with the air intake below the cowling of the radial engine. The main wheels of the tricycle landing-gear are located outboard of the engine nacelles and retract outwardly into the wings. Armament is carried in nose, mid-upper and tail turrets.

Dimensions.—Span 114 ft. (34.7 m.), Length 82 ft. 7 in. (25.2 m.), Height 26 ft. 9 in. (8.16 m.), Wing area 1,300 sq. ft. (11 sq. m.).

Weight Loaded.—81,887 lbs. (37,143 kg.).

Performance.—Maximum speed 398 m.p.h. (640 km.h.) at 16,400 ft. (5,000 m.).

THE MARTIN MODEL 202.

The Model 202 is a twin-engined low-wing transport monoplane which will have accommodation for from 34 to 42 passengers. It was designed to meet the requirements of Air Transport Association Specification A-1 for an aircraft with a high cruising speed for operation on routes where a four-engined aircraft could not be used economically.

By July, 1946, orders for the Model 202 had been placed by Pennsylvania Central Airlines, Chicago and Southern Air Lines, Braniff International Airways, Eastern Air Lines, Northwest Airlines, Delta Air Lines, Dodero (Argentina) and Cruziero do Sul (Brazil). The cargo version of the Model 202 has been ordered by Willis Air Service, Inc. (Commander Airlines). Production was scheduled to begin immediately the prototype has passed its C.A.A. tests.

Type.—Twin-engined Airliner.

Wings.—All-metal cantilever low-wing monoplane. GLM-W 61 laminar-flow aerfoil section. Martin-Van Zelm ailerons with total area of 33 sq. ft. (3.05 sq. m.). Double-slotted trailing-edge flaps between ailerons and fuselage, with total area of 150 sq. ft. (13.94 sq. m.) and auxiliary flap under fuselage with area of 32 sq. ft. (2.96 sq. m.). Hydraulic operation. Gross wing area 860 sq. ft. (79.89 sq. m.).

Fuselage.—All-metal monocoque structure of circular cross-section.

Tail Unit.—Cantilever monoplane type of all-metal construction. Dihedral tailplane with variable incidence. Tailplane incidence interconnected with flaps. Statically-balanced rudder and elevators. Elevators interchangeable left and right. Total vertical area 95.5 sq. ft. (8.86 sq. m.), Total horizontal area 275 sq. ft. (25.24 sq. m.), Tailplane span 26 ft. 6 in. (11.11 m.).

Landing Gear.—Retractable tricycle type, dual wheels fitted to main legs. Main units each consist of single shock-absorber leg and front link members which retract forward into engine nacelles and are fully enclosed. Steerable nose-wheel, carried in fork on shock-absorber leg, retracts forward into fuselage. Hydraulic operation. Track (centre-line of legs) 25 ft. 0 in. (7.62 m.).

Power Plant.—Two Pratt & Whitney R-2800-2SC15G Double-Wasp eighteen-cylinder two-row radial air-cooled engines in tapered cowlings and each developing a normal output of 1,700 h.p., 2,100 h.p. for take-off and a maximum output of 2,400 h.p. for take-off with water injection. Jet-type exhaust system. Hamilton Standard 2C1SB1-18 or Aeroprop A642FN-X22 four-blade reversible airscrews, 13 ft. 6 in. (4.11 m.) diameter. Eight Mareng synthetic rubber fuel cells, four in each wing outboard of engine nacelle with underwing refuelling valves and detachable panels underneath wing for removal of cells.

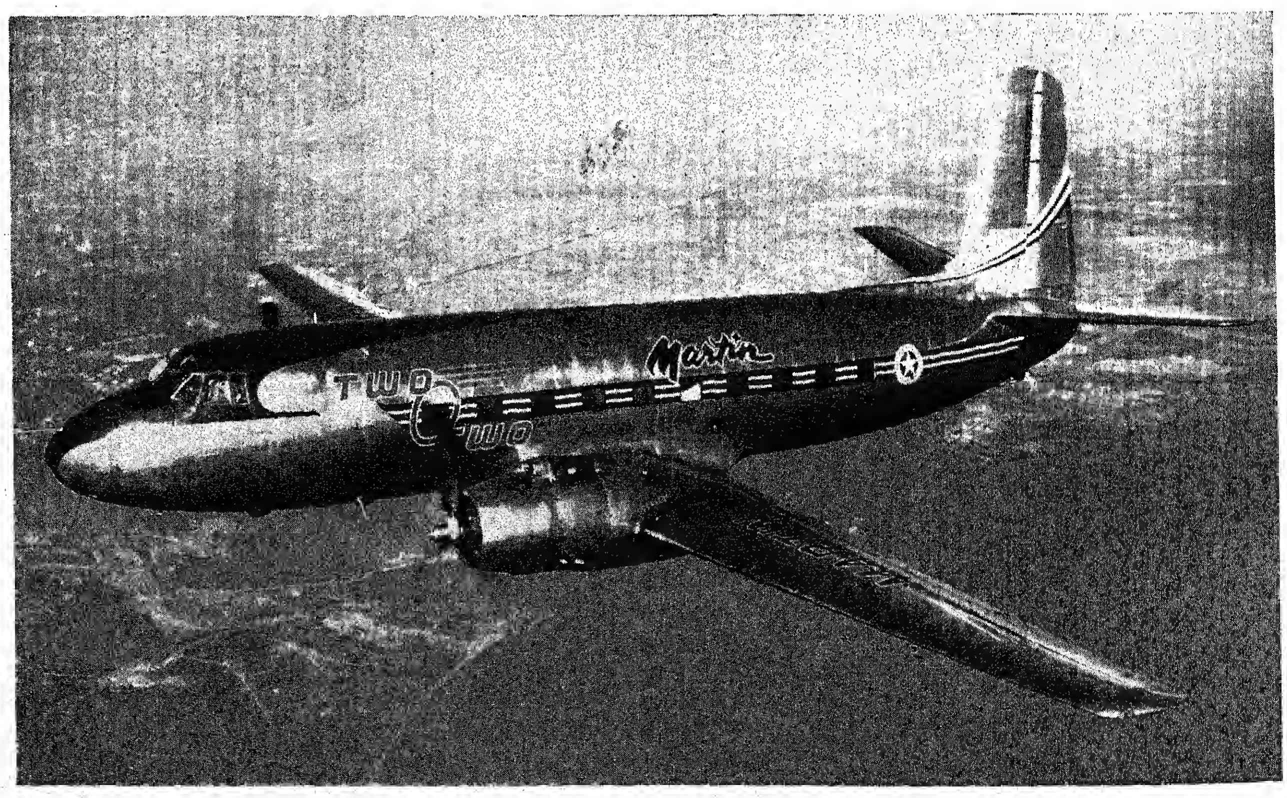
Accommodation.—Crew of three, pilot and co-pilot side-by-side with dual controls, and stewardess. Reinforced hot-air sandwich windscreen and cabin windows. Main passenger cabin is silenced and air-conditioned and has alternative arrangements for from 34 to 42 passengers. Main entry door 3 ft. × 6 ft. (0.91 × 1.83 m.) on port at rear of cabin. Forward freight compartment with capacity of from 120 to 140 cub. ft. (3.39—6.79 cub. m.) according to passenger seats, situated between crew compartment and main cabin. Loading door 3 ft. × 5 ft. 10 in. (0.91 × 1.78 m.) on port. Rear freight compartment with capacity of 56 to 155 cub. ft. (1.57—4.38 cub. m.) according to passenger seats, aft of cabin. Loading door 2 ft. × 4 ft. (0.61 × 1.22 m.) on port. Hydraulically-operated self-contained front and rear loading ramps optional. 63 cub. ft. (1.77 cub. m.) baggage space available under passenger seats. Toilet compartment on starboard at rear.

Equipment.—Radio, hydraulic equipment and other accessory systems carried in space below floor of cabin, with three access panels in fuselage. Thermal anti-icing equipment.

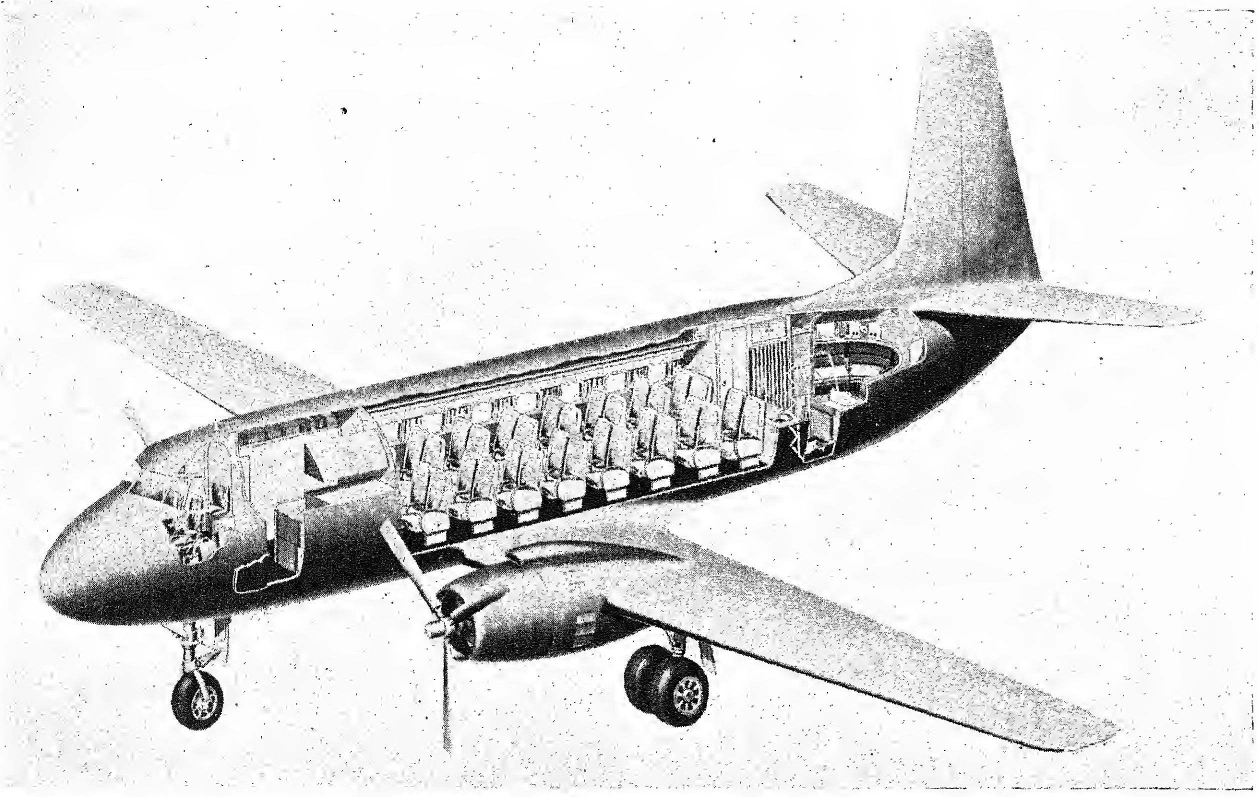
Dimensions.—Span 92 ft. 9 in. (28.26 m.), Length 71 ft. 11 in. (21.91 m.), Height overall 25 ft. 0 in. (7.62 m.).

Weights and Loadings.—Manufacturers' weight empty 22,815 lbs. (10,278 kg.), Designed useful load 8,100 lbs. (3,674 kg.), Normal weight loaded 38,000 lbs. (17,282 kg.), Wing loading 44 lbs./sq. ft. (214.8 kg./sq. m.), Power loading (at 2,100 h.p. per engine) 9 lbs./h.p. (4.1 kg./h.p.).

Performance (Estimated).—Maximum speed 306 m.p.h. (492 km.h.) at 10,000 ft. (3,050 m.), Cruising speed at 70% power 270 m.p.h. (434 km.h.) at 10,000 ft. (3,050 m.), Stalling speed 80 m.p.h. (129 km.h.), Rate of climb at sea level 1,425 ft./min. (434 m./min.), Maximum operational ceiling 30,000 ft. (9,145 m.), One-engine ceiling 7,500 ft. (2,285 m.), Maximum range 1,700 miles (2,736 km.), Take-off distance to 50 ft. (15.m.) 803 yds. (734 m.), Take-off distance to 50 ft. (15 m.) with water injection 583 yds. (533 m.).



The Martin Model 202 Airliner (two Pratt & Whitney R-2800 Double-Wasp engines).—(*Martin & Kelman*).



A sectioned drawing of the Martin Model 303 Twin-engined Airliner showing the interior arrangements.

An all-cargo version of the Model 202 will also be available. In this model all integral passenger entrance ramps will be removed and replaced by a large side cargo door 8 ft. wide by 6 ft. high (2.44 m. × 1.83 m.). A clear interior 50 ft. 6 in. (15.4 m.) long with a strengthened floor covering an area of 367 sq. ft. (34 sq. m.) can be arranged to suit the needs of the individual operator. Bins, shelves, tie-down fittings and other cargo-handling equipment may be readily installed. The aircraft can be provided with refrigerated compartments or the whole interior may be chilled.

The general structure and power-plant of the aircraft will be identical to that of the passenger version except as already noted. The crew will normally consist of pilot and co-pilot.

Two versions will be available, one with a maximum take-off weight of 41,000 lbs. (18,620 kg.) and a range of 1,600 miles (2,560 km.) and the other with a take-off weight of 38,000 lbs. (17,250 kg.) and a range of 1,010 miles (1,620 km.). Pay load will be roughly the same, the difference in loaded weight being that less fuel and other equipment will be required for the shorter range.

Dimensions.—As passenger Model 202.

Weights and Loadings (41,000 lbs.=18,620 kg. take-off weight).—Weight empty 21,380 lbs. (9,710 kg.), Pay load capacity 12,820 lbs. (5,820 kg.), Maximum take-off weight 41,000 lbs. (18,620 kg.), Maximum landing weight 36,500 lbs. (16,570 kg.). Wing loading 45 lbs./sq. ft. (219.7 kg./sq. m.), Power loading 8 lbs./h.p. (3.63 kg./h.p.).

Weights and Loadings (38,000 lbs.=17,250 kg. take-off weight).—Weight empty 21,315 lbs. (9,680 kg.), Pay load capacity 12,885 lbs. (5,850 kg.), Maximum take-off weight 38,000 lbs. (17,250 kg.), Maximum landing weight 36,500 lbs. (16,570 kg.), Wing loading 41.8 lbs./sq. ft. (204 kg./sq. m.), Power loading 7.9 lbs./h.p. (3.57 kg./h.p.).

Performance (41,000 lbs.=18,620 kg. take-off weight).—Maximum speed at normal rated power 290 m.p.h. (464 km.h.) at 10,000 ft. (3,050 m.), Cruising speed at 60% rated power, 240 m.p.h. (384 km.h.) at 10,000 ft. (3,050 m.), Stalling speed at landing weight 80 m.p.h. (128 km.h.), Rate of climb at sea level 1,250 ft./min. (380 m./min.), Maximum operational ceiling 26,500 ft. (8,085 m.), Maximum cruising range (70% power) 1,605 miles (2,570 km.) at 10,000 ft. (3,050 m.).

Performance (38,000 lbs.=17,250 kg. take-off weight).—Maximum speed at normal rated power 292 m.p.h. (467 km.h.) at 10,000 ft. (3,050 m.), Cruising speed at 60% power 245 m.p.h. (392 km.h.) at 10,000 ft. (3,050 m.), Stalling speed at landing weight 80 m.p.h. (128 km.h.), Rate of climb at sea level 1,425 ft./min. (435 m./min.), Maximum operational ceiling 27,500 ft. (8,390 m.), Maximum cruising range (70% power) 1,010 miles (1,620 km.) at 10,000 ft. (3,050 m.).

THE MARTIN MODEL 303.

The Martin Model 303 is similar to the Model 202 but incorporates a pressure cabin which maintains a sea-level pressure up to 8,000 ft. (2,440 m.); a 3,500 ft. (1,065 m.) cabin pressure at 12,000 ft. (3,660 m.), and a 5,000 ft. (1,525 m.) pressure at 16,000 ft. (4,875 m.). The cabin will be 45 ft. long × 9 ft. wide × 6 ft. 9 in. high (13.7 × 2.74 × 2.06 m.) with accommodation for 40 passengers. There will also be an allowance for 2,000 lbs. (907 kg.) of freight. The crew will consist of two pilots and two stewardesses.

The cabin will be provided with thermostatically-controlled "warm-wall" radiant heating, air-conditioning, indirect lighting, etc. Both front and rear entrance doors will be provided, the latter with an integral loading ramp. In addition to baggage racks in the cabin, two small and two large baggage bins will be hinged on to the underside of the fuselage and easily available to ground personnel.

Pratt & Whitney radial engines using a jet thrust exhaust system will be fitted and will drive three-blade reversible-pitch airscrews. Thermal de-icing for wings and tail surfaces will also be provided.

The loaded weight will be approximately 36,750 lbs. (16,670 kg.), of which about 9,500 lbs. (4,309 kg.) is payload. The cruising speed is expected to be about 300 m.p.h. (483 km.h.).

By July, 1946, United Air Lines, Northwest Airlines, Pan American-Grace Airways and Braniff International Airways had placed orders for the Model 303.

Dimensions.—Span 89 ft. 4 in. (12.0 m.), Length 71 ft. 4 in. (21.75 m.), Height (over tail) 28 ft. 5 in. (8.6 m.).

Weights.—Weight empty 23,600 lbs. (10,714 kg.), Take-off weight 36,750 lbs. (16,670 kg.).

THE MARTIN MODEL 304.

The Martin 304 is a modification of the Model 303 which will be powered with turbine-driven airscrews. It will be basically similar to the Pratt & Whitney-powered aircraft, but will have two General-Electric gas-turbine engines driving tractor airscrews and providing additional jet thrust.

The take-off weight of the Model 304 will be approximately 39,000 lbs. (17,690 kg.), nearly 11,500 lbs. (5,216 kg.) of which will be payload. The landing weight will be 34,000 lbs. (15,422 kg.). A maximum speed of 385 m.p.h. (620 km.h.) and a cruising speed of 365 m.p.h. (587 km.h.) are expected.

The prototype of the Model 304 is scheduled to be delivered to United Air Lines in 1947 for service trials.

THE MARTIN MAULER.

U.S. Navy designation: AM-1 (formerly BTM-1).

Type.—Single-seat Attack Bomber.

Wings.—Cantilever low-wing monoplane. All-metal box-type structure consisting of centre-section and two outer sections which fold upwards for stowage. All-metal slotted ailerons with trim- and balance-tabs in each. Intermeshing finger-type dive-brakes opening on top and bottom surfaces, between ailerons and fuselage, and perforated air-brake under fuselage, limit speed in dive to less than 350 m.p.h. (563 km.h.).

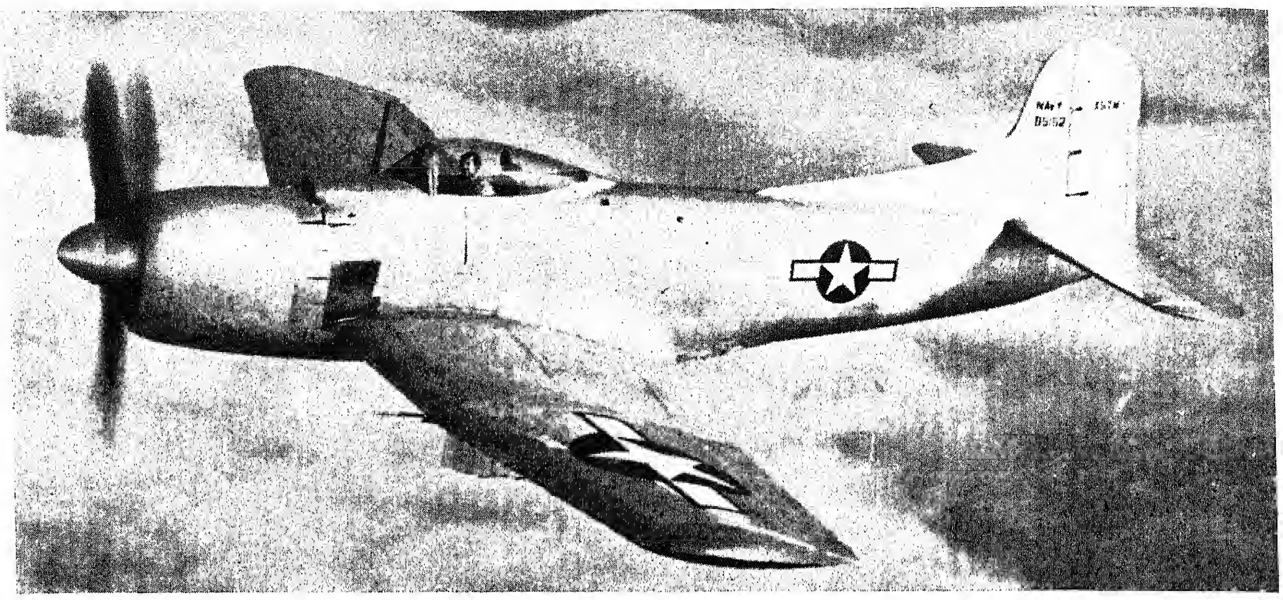
Fuselage.—All-metal flush-riveted semi-monocoque structure.

Tail Unit.—Cantilever monoplane type. Metal structure with metal covering over all surfaces. Balanced rudder and elevators with trim and balance-tabs in each.

Landing Gear.—Retractable two-wheel type. Each main wheel carried in half-fork on shock-absorber leg turns through 90 degrees as it retracts backwards so as to lie flat within wing. Tail wheel retracts into fuselage.

Power Plant.—One 3,000 h.p. Pratt & Whitney R-4360-4 Wasp-Major 28-cylinder four-row radial air-cooled engine enclosed in long

MARTIN*—continued.*



The Prototype Martin XBTM-1 Mauler Single-seat Attack Bomber (Pratt & Whitney R-4360-4 Wasp-Major engine).

chord cowling with controllable trailing-edge gills, and drivng Curtiss-Electric four-blade airscrew, 14 ft. 0 in. (4.27 m.) diameter.
ACCOMMODATION.—Pilot's cockpit has flat *flak*-resisting forward and side panels and bubble canopy which slides backwards for access.
ARMAMENT.—Four 20 m/m. cannon mounted two in each outer wing outside airscrew disc. Bomb-load 4,000 lbs. (1,814 kg.) comprises bomb or torpedo carried externally under fuselage and smaller bombs and/or rocket projectiles under wings. Crutch under fuselage allows bomb to be swung clear of airscrew when released.
DIMENSIONS.—Span 50 ft. 1 in. (15.24 m.), Length 41 ft. 8 in. (12.7 m.).
WEIGHT LOADED (with one 2,000 lb.=907 kg. bomb).—19,500 lbs. (8,845 kg.).
PERFORMANCE.—Maximum speed over 350 m.p.h. (563 km.h.), Maximum diving speed, over 500 m.p.h. (805 km.h.), Maximum range over 1,700 miles (2,736 km.).

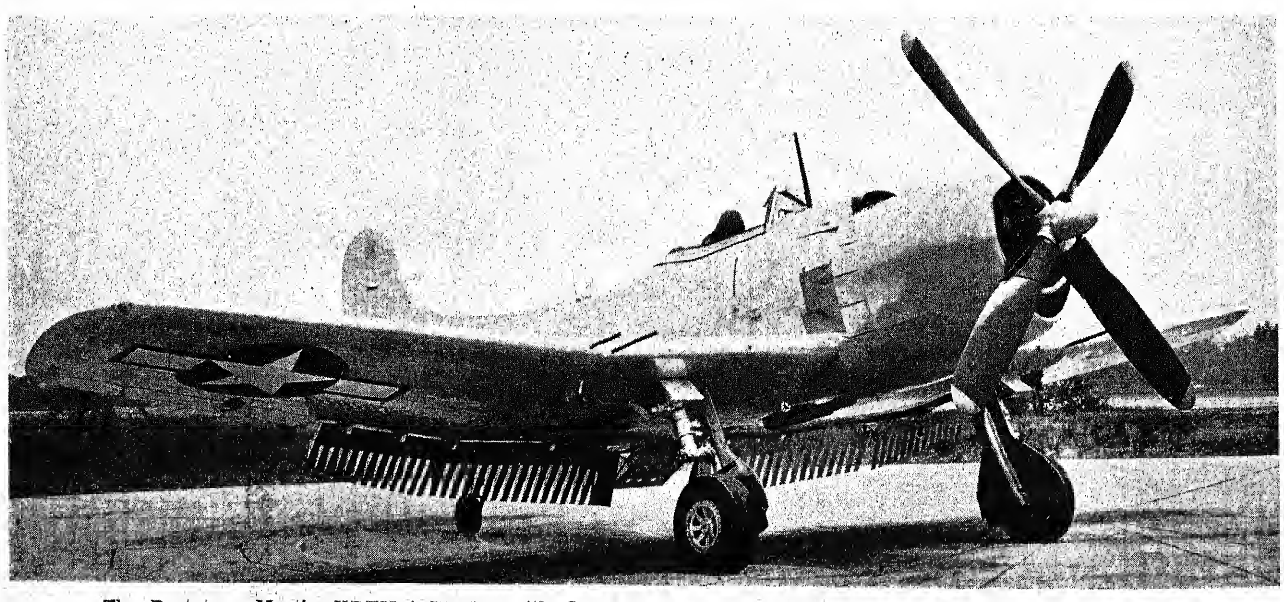
THE MARTIN MODEL 170 MARS.

U.S. Navy designation : XPB2M-1 and JRM-1.

The Mars was originally built as an experimental Patrol Bomber with the designation XPB2M-1. It was subsequently modified as a cargo transport with reinforced floors, larger hatches and loading equipment and re-designated XPB2M-1R.

In December, 1943, the XPB2M-1R made its first service flight as a naval transport, flying from the Patuxent River Naval Air Station, Md. to Natal, Brazil, a distance of 4,375 miles (7,040 km.) non-stop with 13,000 lbs. (5,897 kg.) of mail and freight. The take-off weight for this flight was 148,500 lbs. (67,385 kg.). On part of the return journey a load of 35,000 lbs. (15,874 kg.) was carried. Early in 1944 the Mars completed a 4,700 mile (7,564 km.) round trip to Hawaii in 27 hours 26 min. and delivered 20,500 lbs. (9,298 kg.) of cargo.

The JRM is the production development of the XPB2M-1R. An order for 20 was placed as the result of the successful performance of the prototype with the U.S. Naval Air Transport Service. The first of the new boats was completed in the Summer of 1945, but it foundered after one of its early test flights. The U.S. Navy contract for the JRM was later reduced to five aircraft. The fourth JRM-1 was delivered to the U.S. Navy in the Summer of 1946. A fifth aircraft with an improved power-plant installation is being completed as the JRM-2.
TYPE.—Four-engined Military Transport Flying-Boat.
WINGS.—Cantilever high-wing monoplane. Aerofoil section NACA 23020 at root tapering to NACA 23012 at tip. All-metal structure consisting of centre-section, two outer wings and detachable tips. Constant taper in chord and thickness from roots. Metal ailerons with trim and balance-tabs in each. All-metal split trailing-edge flaps in four sections, two each side. Gross wing area 3,686 sq. ft. (342.3 sq. m.).
HULL.—Aluminium-alloy semi-monocoque structure divided into two decks. Total volume 16,655 cub. ft. (471.4 cub. m.), Gross displacement 995,000 lbs. (451,320 kg.). All-metal wing-tip floats carried on cantilever V-struts.
TAIL UNIT.—Cantilever monoplane type. Metal structure with dihedral tailplane. Balanced rudder and elevators with controllable trim-tab in each.
POWER PLANT.—Four Wright R-3350-8 Duplex-Cyclone eighteen-cylinder two-row radial air-cooled engines fitted with single-stage two-speed superchargers, each developing a normal output of 2,100 h.p. at 2,500 ft. (760 m.); 1,800 h.p. at 13,600 ft. (4,145 m.), and a maximum output of 2,250 h.p. for take-off (JRM-1) or four Pratt & Whitney R-4360 Wasp-Major twenty-eight-cylinder four-row radial air-cooled engines fitted with one-stage, variable-speed superchargers, each developing a normal output of 2,500 h.p. at 5,000 ft. (1,525 m.), 2,200 h.p. at 14,500 ft. (4,420 m.) and a maximum output of 3,000 h.p. for take-off (JRM-2). Engines mounted as power-eggs on welded steel-tube structures and are accessible in flight from wings. Curtiss-Electric four-blade airscrew 16 ft. 8 in. (5.08 m.) diameter. Total fuel capacity 13,220 U.S. gallons (50,040 litres) in six integral fuel tanks under floor of lower deck and two in removable wing-tanks.
ACCOMMODATION.—Pressurized hull divided into two decks. Normal crew of eleven. Flight deck forward accommodates duty crew of



The Prototype Martin XBTM-1 Mauler with flaps extended. This aircraft is in production as the AM-1.

***MARTIN**—continued.*

The Martin JRM-1 Mars Transport Flying-Boat (four Wright R-3350-8 Duplex-Cyclone engines).

four, and aft of the pilot's compartment are four bunks for the use of off-duty officers on long flights. Four further bunks provided on the upper rear deck aft of the auxiliary power-plant compartment. Washroom facilities right aft in the tail section which is reached from upper deck. In nose ahead of flight deck is the stowage for anchors and the anchor windlass, and aft of this and ahead of main cargo hold is a combined galley and entrance to the flight deck. Main deck provided with cargo tie-down fittings running fore-and-aft and athwartships on 30 in. (76.2 c/m.) centres, metal skid strips for sliding heavy cargo and tracks fore-and-aft and athwartships for handling engine dollies. A 5,000-lb. (2,266-kg.) capacity cargo hoist on overhead track runs out 20 ft. (6.1 m.) under both wings through main loading hatches, each of which is 8 ft. 3 in. wide × 7 ft. 10 in. high (2.52 m. × 3.24 m.) with doors divided vertically and opening outwards. Two further hatches 4 ft. 2 in. wide × 5 ft. 2 in. high (1.27 m. × 1.5 m.) located just forward of the second step with doors which slide up inside the hull. Aft of main cargo hold is a stairway leading to upper deck. Trap doors 4 ft. 2 in. long × 2 ft. wide (1.27 m. × 0.6 m.) in upper deck floor and immediately above the after loading doors for loading low density freight on to the upper deck. Built-in fittings permit rapid conversion into an ambulance to carry 84 stretcher cases and 25 medical attendants ; a passenger transport to carry fifty in chairs all on the main deck ; or a troop-carrier to accommodate 132 troops, all seated.

Dimensions.—Span 200 ft. 0 in. (60.96 m.), Length 120 ft. 3 in. (36.65 m.), Height 47 ft. 11 in. (14.6 m.).

Weights and Loadings (JRM-1).—Weight empty 75,000 lbs. (34,018 kg.), Weight loaded 145,000 lbs. (65,770 kg.), Wing loading 39.3 lbs. sq. ft. (191.8 kg./sq. m.), Power loading 16.1 lbs./h.p. (7.29 kg./h.p.),

Weights and Loadings (JRM-2).—Weight empty 75,000 lbs. (34,018 kg.), Weight loaded 165,000 lbs. (74,842 kg.), Wing loading 44.7 lbs./sq. ft. (218.2 kg./sq. m.), Power loading 13.75 lbs./h.p. (6.22 kg./h.p.).

Performance (JRM-1).—Maximum speed 207 m.p.h. (333 km.h.) at sea level, Cruising speed (approximate) 152 m.p.h. (245 km.h.).

Performance (JRM-2).—Maximum speed 220 m.p.h. (354 km.h.) at sea level.

THE MARTIN MODEL 162 MARINER.

U.S. Navy designations : PBM.

The XPBM-1 was originally ordered by the U.S. Navy in 1936. Before it was built a quarter-scale flying prototype (Model 162A) was built and flown. The full-size prototype was delivered to the U.S. Navy in 1938.

The PBM-1, fitted with two Wright R-2600-6 radial air-cooled engines, a dihedral tail and retractable wing-tip floats, was ordered in 1938, and was followed in 1939 by an experimental XPBM-2, a long-range model specially strengthened for catapult take-off.

The PBM-3, with two Wright R-2600-12 engines, was ordered in quantity in 1941 and deliveries began in 1942. In the PBM-3 the crew was increased from seven to nine, the armament was revised and fuel capacity increased. The retractable wing-tip floats of the PBM-1 were replaced by fixed floats.

In 1942 the PBM-3 was adopted as a naval transport and given the designation PBM-3R. Structural changes included the removal of all military equipment, turrets, etc., and the provision of a strengthened floor, cargo-loading door and facilities for loading and handling cargo. The PBM-3R carried 40 passengers or 8,000-9,000 lbs. (3,630-4,090 kg.) in freight and cargo. At an all-up weight of 48,000 lbs. (21,800 kg.) it has a range of 1,200 miles (1,920 km.) at a cruising speed of 150 m.p.h. (240 km.h.).

The long-range PBM-3S is used by the U.S. Coast Guard on Air/Sea Rescue and other similar duties.

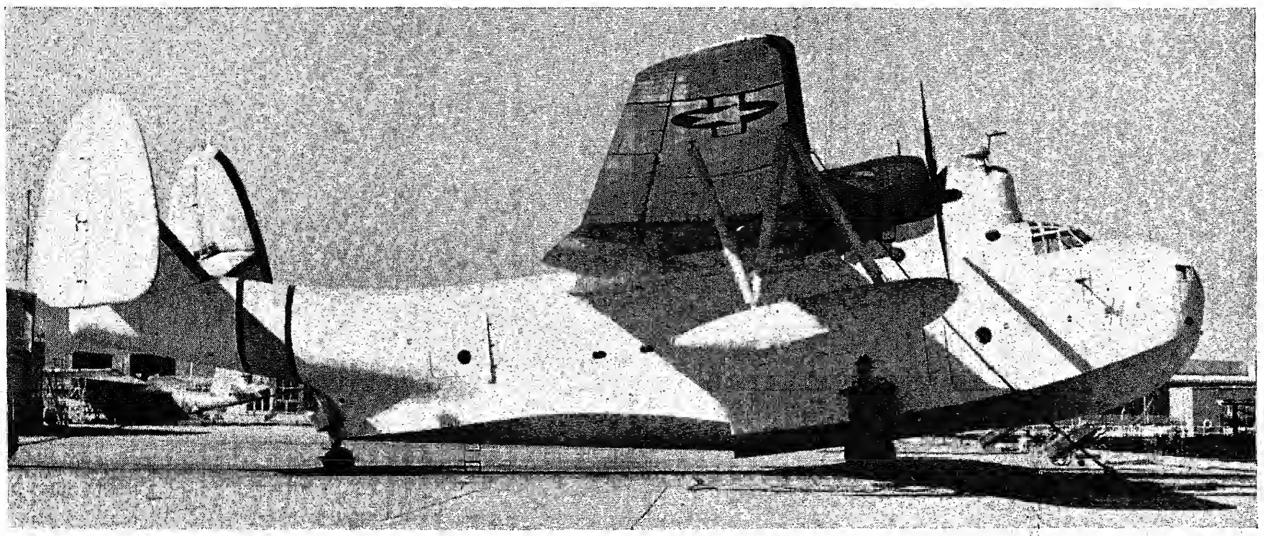
The PBM-5 is fitted with two Pratt & Whitney R-2800-22 engines in redesigned nacelles and has certain internal design changes to give greater capacity and longer range.

The XPBM-5A is an amphibian version of the PBM-5. The forward portion of the hull where the landing-gear is located has been completely redesigned with reinforced bulkheads, new floor frames and stronger beams. The main wheels operate on a single steel shaft or trunnion and are raised into the sides of the hull and lowered hydraulically. The nose wheel retracts into the underside of the hull. The hull redesign and amphibian gear adds 4,500 lbs. (2,045 kg.) to the total weight of the aircraft. The maximum take-off weight of the XPBM-5A is 64,000 lbs. (29,060 kg.) on land and 56,000 lbs. (25,425 kg.) on water.

Type.—Twin-engined Patrol-Bomber or Naval Transport.

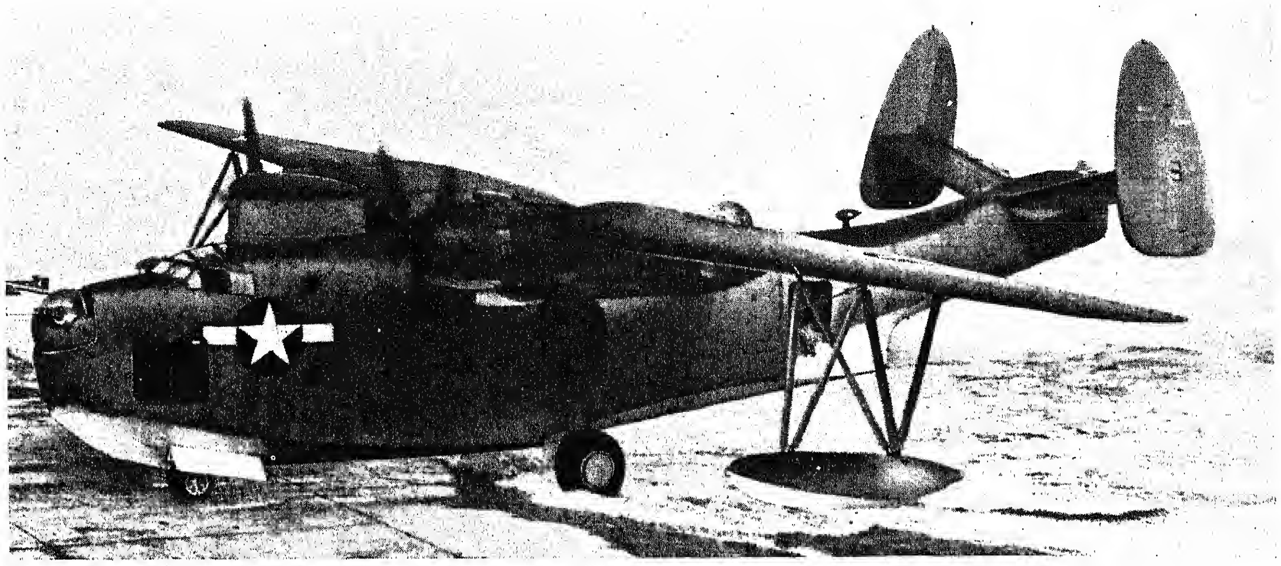
Wings.—High-wing cantilever monoplane. Inner sections of wing set at coarse dihedral and outer wings at no dihedral. Constant taper and rounded wing-tips. All-metal structure with flush-riveted smooth metal skin. Entire trailing-edge hinged, outer sections acting as ailerons and inner sections as flaps.

Hull.—All-metal two-step structure, the rear step terminating in a vertical knife-edge. Fixed stabilising floats attached to wings by N-struts.



The Martin PBM-3S Mariner used for Air/Sea Rescue duties with the U.S. Coast Guard.—(*William T. Larkins*).

MARTIN—*continued.*



The Martin XPBM-5A Mariner Flying-Boat Amphibian (two Pratt & Whitney R-2800-22 Double-Wasp engines).

Tail Unit.—Cantilever monoplane type with twin-fins and rudders. Dihedral tailplane with fins and rudders mounted at right angles to the tailplane surfaces. All-metal structure with metal-covered fixed surfaces and fabric-covered elevators and rudders. Statically and aerodynamically-balanced control surfaces.

Power Plant.—Two 2,000 h.p. Pratt & Whitney R-2800-22 fourteen-cylinder two-row radial air-cooled engines on mountings at the extremities of the centre-section. Curtiss Electric three or four-blade constant-speed full-feathering airscrews. Self-sealing fuel cells in wings. Provision for rocket-assisted take-off.

Accommodation.—Provision for crew of seven or nine. Equipment includes galley, sleeping accommodation, sound-proofing, heating and ventilation.

Armament.—Eight 0.5 in. (12.7 m/m.) machine-guns in turrets in nose, amidships and in extreme tail and in beam gun positions in the sides of the hull midway between wings and tail. Internal stowage for 4,000 lbs. (1,814 kg.) of bombs or depth-charges in engine nacelles beneath wings. Crutches for 21 in (53.3 c/m.) torpedo inboard of each nacelle.

Dimensions.—Span 118 ft. (36 m.), Length 77 ft. 2 in. (23.5 m.), Height 17 ft. 6 in. (5.33 m.).

Weights and Loadings.—Weight loaded 56,000 lbs. (25,425 kg.), Wing loading 40 lbs./sq. ft. (195.3 kg./sq. m.), Power loading 14 lbs./h.p. (6.34 kg./h.p.).

Performance.—Maximum speed over 200 m.p.h. (322 km.h.), Maximum range 3,000 miles (4,828 km.).

MEYERS.

MEYERS AIRCRAFT COMPANY.

Head Office and Works : Tecumseh, Mich.

President and Chief Engineer : A. H. Meyers.

The Meyers Aircraft Company was formed in 1936. It specialises in the design and manufacture of light training and touring aircraft, aircraft wheels and shock-absorber struts.

In 1945 production was concentrated on the Model OTW-160, the entire output of which was delivered to flying schools.

The latest Meyers design is the MAC 125-C two-seat low-wing monoplane.

THE MEYERS OTW-160.

Type.—Two-seat light training biplane.

Wings.—Equal-span single-bay staggered biplane. Centre-section carried above fuselage on splayed-out N-struts, with one set of N-type interplane struts on each side of fuselage. Lower wings attached to stubs built integral with fuselage. Structure consists of solid spruce spars, spruce and plywood ribs and fabric covering. Wing area 262 sq. ft. (24.33 sq. m.). Metal ailerons on lower wings only.

Fuselage.—Oval metal structure of semi-monocoque construction to rear cockpit and full monocoque thence to tail. Structure of 24ST Alclad.

Tail Unit.—Braced monoplane type. Vertical surfaces are of riveted 24ST Alclad including the covering. Horizontal surfaces have metal frames and fabric covering. Adjustable tail-plane.

Landing Gear.—Divided type. Upper ends of main compression legs attached to upper fuselage longerons with the lower ends hinged by interchangeable V-struts to the centre-line of the underside of the fuselage. Swivelling tail-wheel.

Power Plant.—One 160 h.p. Kinner R-56 seven-cylinder radial air-cooled engine on welded steel-tube mounting. Fuel tank of 26 U.S. gallons (98 litres) capacity in fuselage aft of fireproof bulkhead.

Accommodation.—Tandem open cockpits with dual controls. Baggage compartment aft of rear seat.

Dimensions.—Span 30 ft. (9.14 m.), Length 22 ft. 8 in. (7.91 m.), Height 8 ft. 6 in. (2.59 m.).

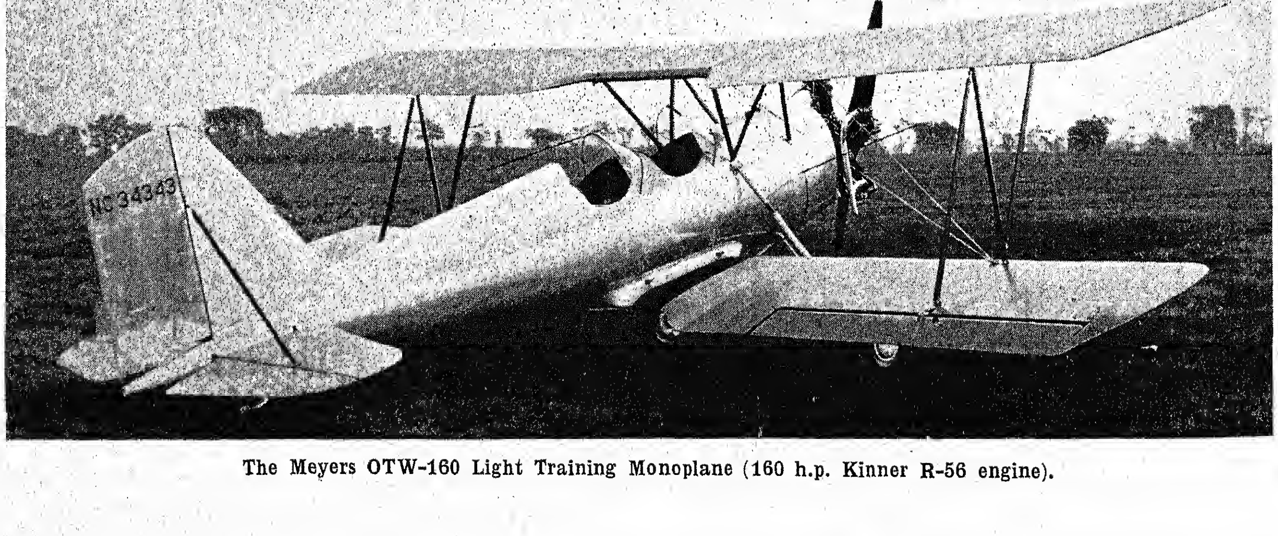
Weights and Loadings.—Weight empty 1,340 lbs. (608 kg.), Pay load 200 lbs. (91 kg.), Disposable load 570 lbs. (259 kg.), Weight loaded 1,910 lbs. (867 kg.), Wing loading 7.25 lbs./sq. ft. (35.4 kg./sq. m.), Power loading 11.81 lbs./h.p. (5.35 kg./h.p.).

Performance.—Maximum speed 120 m.p.h. (193 km.h.), Cruising speed 105 m.p.h. (169 km.h.), Landing speed 40 m.p.h. (64 km.h.), Initial rate of climb 1,200 ft./min. (366 m./min.), Service ceiling 17,500 ft. (5,335 m.), Cruising range 400 miles (640 km.).

THE MEYERS MAC 125-C.

Type.—Two-seat Cabin monoplane.

Wings.—Cantilever low-wing monoplane. Aerofoil section (root) NACA 23015 ; (tip) NACA 23009. All-metal structure in three main sections consisting of centre-section integral with fuselage and two outer wings. Stressed skin covering. Gross wing area



The Meyers OTW-160 Light Training Monoplane (160 h.p. Kinner R-56 engine).

MEYERS—*continued.*

The Meyers MAC 125-C Two-seat Cabin Monoplane (125 h.p. Continental C125 engine).

149 sq. ft. (13.84 sq. m.). Built-in leading-edge slots at tips. All-metal ailerons with metal covering. Area (each) 5.38 sq. ft. (0.5 sq. m.). All-metal slotted flaps; area (each) 6.67 sq. ft. (0.62 sq. m.).

Fuselage.—All-metal monocoque structure with stressed skin.

Tail Unit.—Cantilever monoplane type. All-metal structure with stressed metal skin over all surfaces. Controllable trim-tabs in elevators, and rudder trim-tab adjustable on ground. Tailplane area 13.15 sq. ft. (0.94 sq. m.); elevator area (each) 8.84 sq. ft. (0.82 sq. m.); fin area 5.33 sq. ft. (0.49 sq. m.); rudder area 3.69 sq. ft. (0.34 sq. m.).

Landing Gear.—Retractable two-wheel type. Main wheels retract inwards under fuselage. Hydraulic operation. Hydraulic brakes. Track 9 ft. 7 in. (2.92 m.). Non-retractable tailwheel carried in fork on oleo-spring shock-absorber leg.

Power Plant.—One 125 h.p. Continental C125 four-cylinder horizontally-opposed air-cooled engine driving two-blade wooden airscrew. Fual capacity 30 U.S. gallons (113 litres); oil capacity 2 U.S. gallons (7.5 litres).

Accommodation.—Enclosed cabin seating two-by-side. Luggage compartment at rear of cabin; allowance 50 lbs. (22.6 kg.).

Dimensions.—Span 30 ft. 0 in. (9.14 m.), Length 20 ft. 10 in. (6.35 m.), Height 8 ft. 6 in. (2.59 m.).

Weights and Loadings.—Weight empty 1,090 lbs. (494 kg.), Useful load 585 lbs. (265 kg.), Weight loaded 1,675 lbs. (760 kg.), Wing loading (fully loaded) 11.24 lbs./sq. ft. (54.88 kg./sq. m.), Power loading (fully loaded) 13.4 lbs./h.p. (6.08 kg./h.p.).

Performance.—Maximum level speed 140 m.p.h. (225 km.h.), Cruising speed 120 m.p.h. (193 km.h.), Landing speed (with flaps) 47 m.p.h. (76 km.h.), (Without flaps) 54 m.p.h. (87 km.h.), Climb at sea level 700 ft./min. (213 m./min.), Range, with maximum fuel of 30 U.S. gallons (113 litres) 500 miles (805 km.).

THE NAVAL AIR MATERIAL CENTER.

U.S. Naval Base Station, Philadelphia 12, Pa.

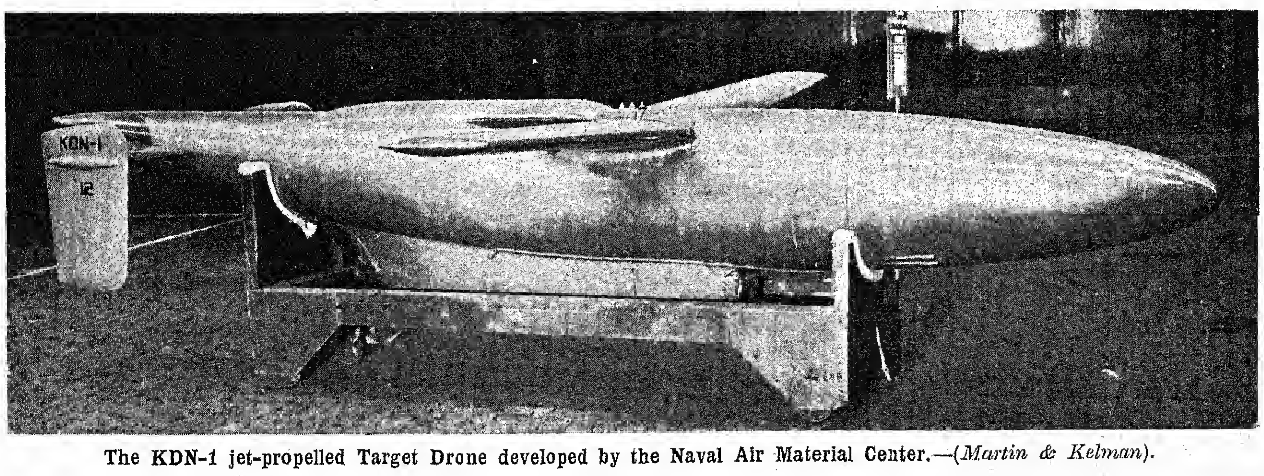
During the war the former Naval Aircraft Factory underwent a complete reorganization and is now established as the Naval Air Material Center. The Center includes the following; (*a*) The Naval Aircraft Factory; (*b*) The Naval Aircraft Modification Unit; (*c*) The Naval Air Experimental Station and (*d*) The Naval Auxiliary Air Station, Mustin Field. The former supply depot functions have been detached from this organization.

The Naval Aircraft Factory, the manufacturing branch of the Center, builds complete aircraft of both Factory and external design.

The Naval Aircraft Modification Unit is engaged in prototype and production modification of Naval aircraft and in the development of pilotless aircraft. Among its many developments in the pilotless aircraft category may be mentioned the KUN-1 Gorgon IIC, a ship-to-shore flying-bomb launched by catapult, propelled by a Resojet unit and radio-controlled from the air or ship or by an automatic "seeing-eye"; the KU3N-1 Gorgon IIIA, a rocket-propelled air-launched weapon for use against air or ground targets; and the KDN-1, a target-drone propelled by a Westinghouse 9.5 axial-flow jet-unit and with an automatically-releasable parachute for recovery after use. It has also converted the Hellcat F6F-5 into a high-speed radio-controlled pilotless drone. This unit is located at Johnsville, Pennsylvania, in a plant formerly occupied by the Brewster Aeronautical Corporation.

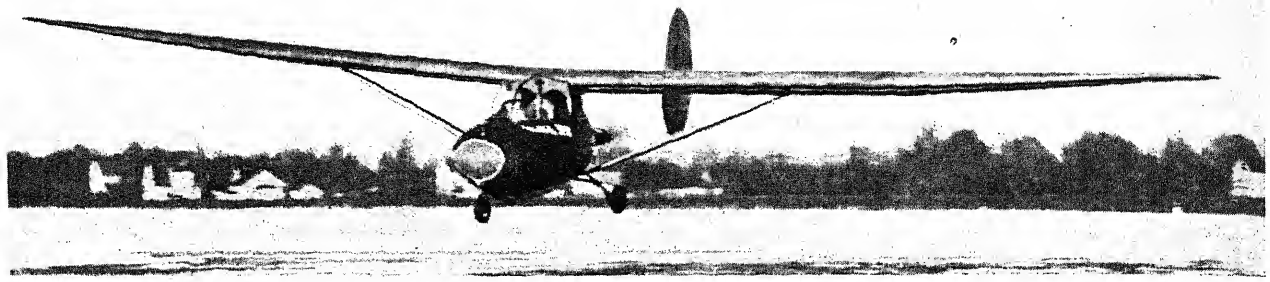
The Naval Air Experimental Station includes: (1) The Aeronautical Engine Laboratory, handling the test and development of engines and power plant accessories; (2) The Aeronautical Materials Laboratory, handling test and development of metals, fabrics, paints, dopes, finishes, etc., as well as numerous accessories and articles of equipment; also the test and development of aircraft structures; (3) The Aeronautical Instrument Laboratory, which handles development and test of specialized aeronautical instruments; (4) The Radio and Radar Laboratory, which handles special developments and tests of radio and radar, and specialized electronics equipment; (5) The Aero Medical Department, engaged in the development and test of oxygen equipment and personal flying equipment; (6) The Aeronautical Photographic Experimental Laboratory, which designs, modifies, and tests specialized photographic equipment.

The Naval Auxiliary Air Station, Mustin Field, handles all flight test and other flying activities of the Naval Air Material Center and is designated a military airport and seaplane base.



The KDN-1 jet-propelled Target Drone developed by the Naval Air Material Center.—(*Martin & Kelman*).

NELSON.



The Nelson Dragonfly Two-seat Auxiliary-powered Sailplane (25 h.p. Nelson two-stroke engine).

THE NELSON AIRCRAFT CORPORATION.

HEAD OFFICE: SAN LEANDRO, NEAR OAKLAND, CALIFORNIA.
President: Ted Nelson.
Vice-President and Designer: Wm. Hawley Bowlus.
Secretary: C. H. Whitner.
Vice-President and Sales Manager: Rheule Reitze.

The Nelson Aircraft Corporation was formed late in 1945 to manufacture light civilian aircraft, including the Nelson Dragonfly (formerly known as the Bumble-bee) auxiliary powered sailplane. The prototype of this aircraft was successfully flown with auxiliary engines of from 16 to 25 h.p.

After some confusion arising from the difficulty of deciding into which class of aircraft the Dragonfly should fall, the C.A.A. established a new class for combined powered aircraft and gliders specially for the Dragonfly before awarding it an Approved Type Certificate.

THE NELSON DRAGONFLY MODEL BB-1.

TYPE.—Two-seat Auxiliary-powered Sailplane.

WINGS.—Strut-braced high-wing monoplane, with centre-section integral with fuselage. Single-spar spruce structure with D-section plywood leading-edge. Maximum chord 4 ft. 0 in. (2.12 m.). Gross wing area 169.3 sq. ft. (15.73 sq. m.), Aspect ratio 13.25. Wings detachable for transport, etc. Long-span wooden ailerons, Area (total) 24.2 sq. ft. (2.25 sq. m.).

FUSELAGE.—Pod-shaped moulded plastic plywood structure with a duralumin boom carrying the tail-unit.

TAIL UNIT.—Cantilever monoplane type. Spruce structure with plywood and fabric covering. Elliptical fin and rudder equally disposed above and below boom. Tailplane span 9 ft. 0 in. (2.74 m.); tailplane and elevator area 21.5 sq. ft. (2 sq. m.); fin and rudder area 11.78 sq. ft. (1.09 sq. m.).

LANDING GEAR.—Retractable tricycle type, all wheels retracting into fuselage. Steerable nose-wheel operated by rudder pedals. Independent brakes on main wheels.

POWER PLANT.—One Nelson four-cylinder two-stroke horizontally-opposed air-cooled engine mounted as pusher unit on steel-tube bearers at rear end of front fuselage. Engine rated at 20 h.p. at 3,800 r.p.m., with 25 h.p. available for take-off. Two-blade fixed-pitched wooden propeller. Ratchet starter controllable from cockpit. Fuel capacity 3 U.S. gallons (11 litres) in single tank.

ACCOMMODATION.—Single cockpit seating two side-by-side with dual controls. Removable transparent cockpit enclosure.

DIMENSIONS.—Span 47 ft. 4 in. (14.42 m.), Length 19 ft. 8 in. (5.99 m.), Height (over fuselage) 4 ft. 7 in. (1.33 m.), Height (over rudder) 6 ft. 10 in. (2.08 m.).

WEIGHTS AND LOADINGS.—Weight empty 465 lbs. (211 kg.), Disposable load 435 lbs. (197 kg.), Weight loaded 900 lbs. (408 kg.), Wing loading (fully loaded) 5.31 lbs./sq. ft. (25.92 kg./sq. m.), Power loading (at take-off, fully loaded) 36 lbs./h.p. (16.33 kg./h.p.).

PERFORMANCE (with engine for take-off and intermittent use).—Cruising speed 70 m.p.h. (113 km.h.), Landing speed 36-40 m.p.h. (58-64 km.h.), Stalling speed 35 m.p.h. (56 km.h.), Climb 300 ft./min. (91 m./min.), Cruising range 105 miles (169 km.), Take-off run 585 ft. (178 m.), Take-off time 18 seconds, Power duration 3 hours, Fuel consumption 2 U.S. gallons/hr. (7.6 litres/hr.).

PERFORMANCE (without use of engine).—Minimum sinking speed, 3.9 ft./sec. (1.18 m./sec.), Best gliding ratio 20 : 1.

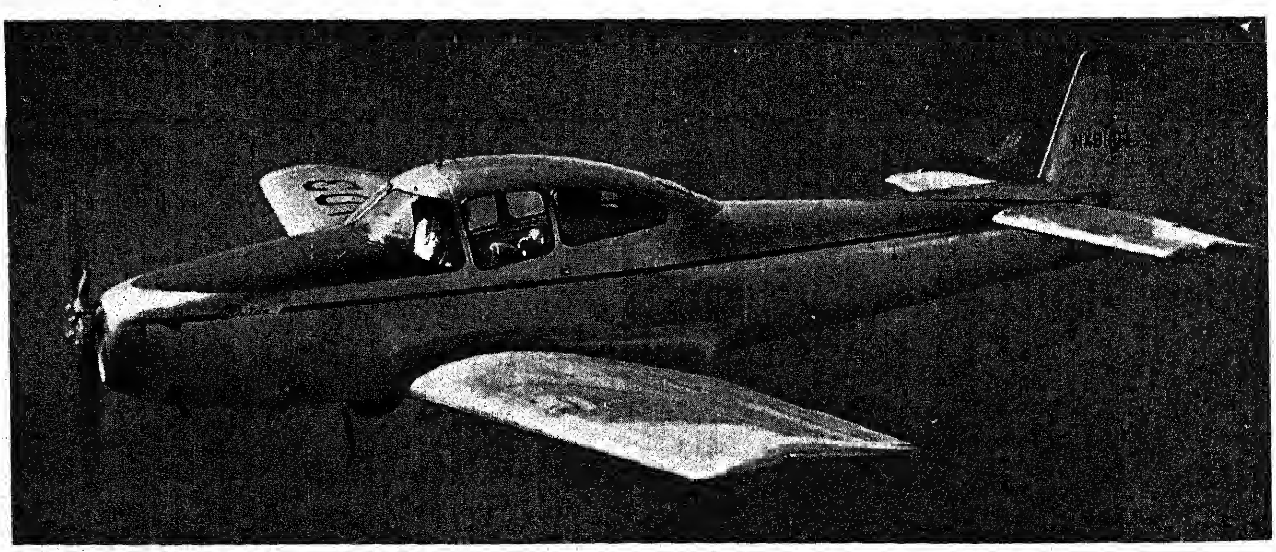
NORTH AMERICAN.

NORTH AMERICAN AVIATION, INC.

HEAD OFFICE AND WORKS: 5,701, IMPERIAL HIGHWAY, INGLEWOOD, CAL.
NEW YORK OFFICE: 1775, BROADWAY, NEW YORK.
President and General Manager: J. H. Kindelberger.
First Vice-President: J. L. Atwood.
Vice-President in charge of Engineering: R. H. Rice.
Vice-President and Treasurer: R. A. Lambeth.

North American Aviation, Inc., was incorporated in Delaware in 1928 and from 1934 until 1945 was engaged solely in the design and manufacture of military aircraft. Manufacturing facilities were established at Inglewood, Calfornia, in 1935, where a modern production plant was erected on the Los Angeles Municipal Airport. Early types of aircraft built under contract included the BT-9, NJ-1, BC-1, BT-14, AT-6, SNJ-1 and O-47 for the United States Army and Navy, Harvards for the R.A.F. and R.C.A.F., and trainers for nine other foreign nations. Production of the B-25 Mitchell bomber and the Mustang began in 1940.

With wartime refinements and improvements the AT-6 Texan, the B-25 Mitchell and the P-51 Mustang were maintained in production right up to VJ-Day. A new fighter, the P-82 Twin Mustang, was ready for quantity production when the war ended and production of the Fairchild C-82 Packet and Lockheed P-80 Shooting Star was also under way.



The North American Navion Four-seat Cabin Monoplane (185 h.p. Continental E185 engine).

***NORTH AMERICAN**—continued.*

The North American Navion Four-seat Cabin Monoplane (185 h.p. Continental E185 engine).

With the surrender of Japan North American ceased operations at the Kansas City and Dallas plants and contracts for the AT-6, B-25, C-82 and P-80 were terminated. All operations were again concentrated at the company's West Coast plant where the P-51 continued in production until November, 1945, to be superseded by the P-82.

With the completion of the P-51 programme, North American had built 15,302 fighter aircraft since June, 1940. In addition, 10,784 B-25 and B-24 bombers and 15,117 AT-6 trainers had been produced in the same period.

North American made its entry into the light personal aeroplane field in April, 1946, with the Navion four-seat all-metal cabin monoplane, described hereafter. Production of the P-82 continues and research and development proceeds on a number of military aeroplanes, including the XP-86 jet-propelled fighter and the XB-45 jet-propelled bomber.

On February 27-28, 1947, a specially-equipped P-82 flew from Honolulu to New York non-stop, a distance of 4,978 miles (7,965 km.) in 14 hrs. 33 min., the longest flight ever made by a fighter type aircraft.

THE NORTH AMERICAN N.A. 145 NAVION.

Type.—Four-seat Cabin monoplane.

Wings.—Cantilever low-wing monoplane. All-metal two-spar structure in two main sections each attached directly to fuselage. Detachable wing-tips. Channel-section spars, built-up ribs and stressed metal covering. Incidence washed-out 3 degrees at tips. Wing area 184 sq. ft. (17.09 sq. m.). All-metal mass-balanced ailerons and hydraulically-operated trailing-edge flaps. Flap positions 20 degrees for take-off, 40 degrees for landing.

Fuselage.—All-metal semi-monocoque one-piece structure, with four main longerons, transverse bulkheads and frames and aluminium-alloy stressed-skin covering.

Tail Unit.—Cantilever monoplane type with detachable tips. Metal structure with metal covering to all surfaces. Two-piece tailplane and elevators interchangeable left and right. Controllable trim-tab in each elevator, rudder tab adjustable on ground.

Landing Gear.—Retractable tricycle type. Each main wheel, on single air-oil shock-absorber leg, retracts inwards into wings. Nose-wheel, in fork on air-oil shock-absorber leg, retracts backward into fuselage, leaving small portion projecting. Nose-wheel steerable 20 degrees each way. Hydraulic operation with emergency spring-lowering gear. Track 8 ft. 2¼ in. (2.49 m.) wheel base 5 ft. 8½ in. (1.73 m.). Leaf-spring emergency tail-skid.

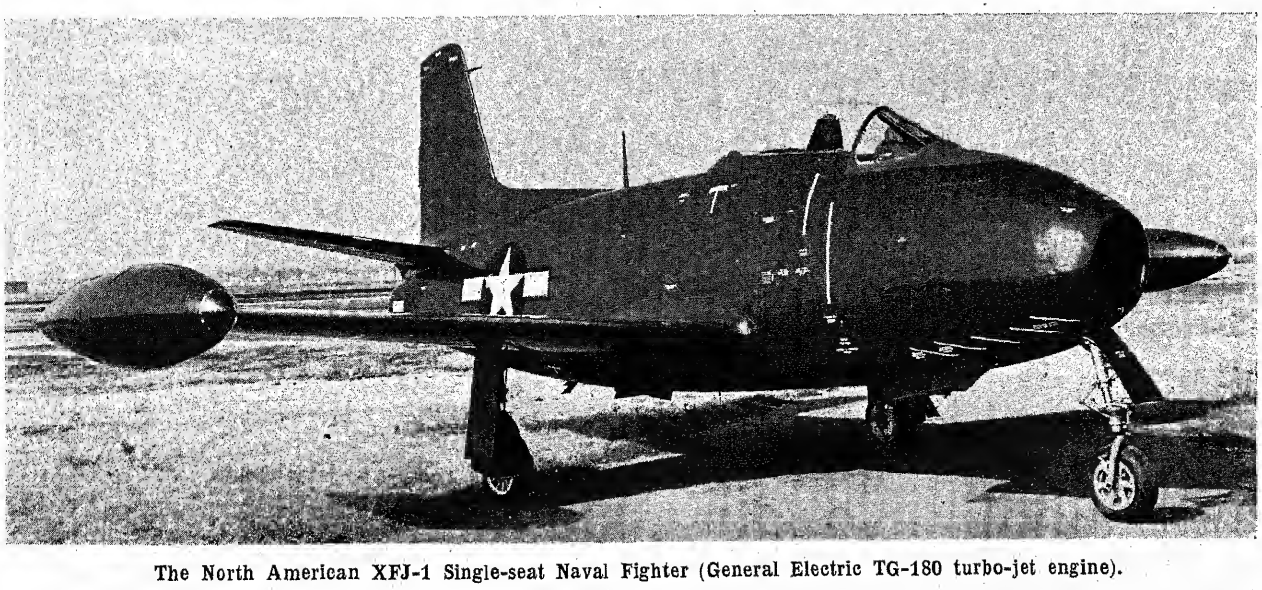
Power Plant.—One Continental E185 six-cylinder horizontally-opposed air-cooled direct-drive engine developing 185 h.p. at 2,300 r.p.m. and mounted on removable cantilever bearers. Hartzell or Aeromatic two-blade variable-pitch airscrew. Fuel capacity 40 U.S. gallons (151 litres). Oil 2½ U.S. gallons (9.4 litres). Delco-Remy 15-volt generator.

Accommodation.—Enclosed cabin seating four, two in front side-by-side with dual controls and two behind on full-width seat. Lucite windshield in aluminium frame. Aluminium-alloy sheet canopy with Plexiglas side panels slides backwards for access. Cabin interior width 3 ft. 9 in. (1.14 m.). Baggage compartment aft of rear seats.

Dimensions.—Span 33 ft. 4 3/16 in. (10.16 m.), Length 27 ft. 5 13/16 in. (8.36 m.), Height over cabin 7 ft. 3½ in. (2.22 m.), Height overall 8 ft. 7⅝ in. (2.62 m.).

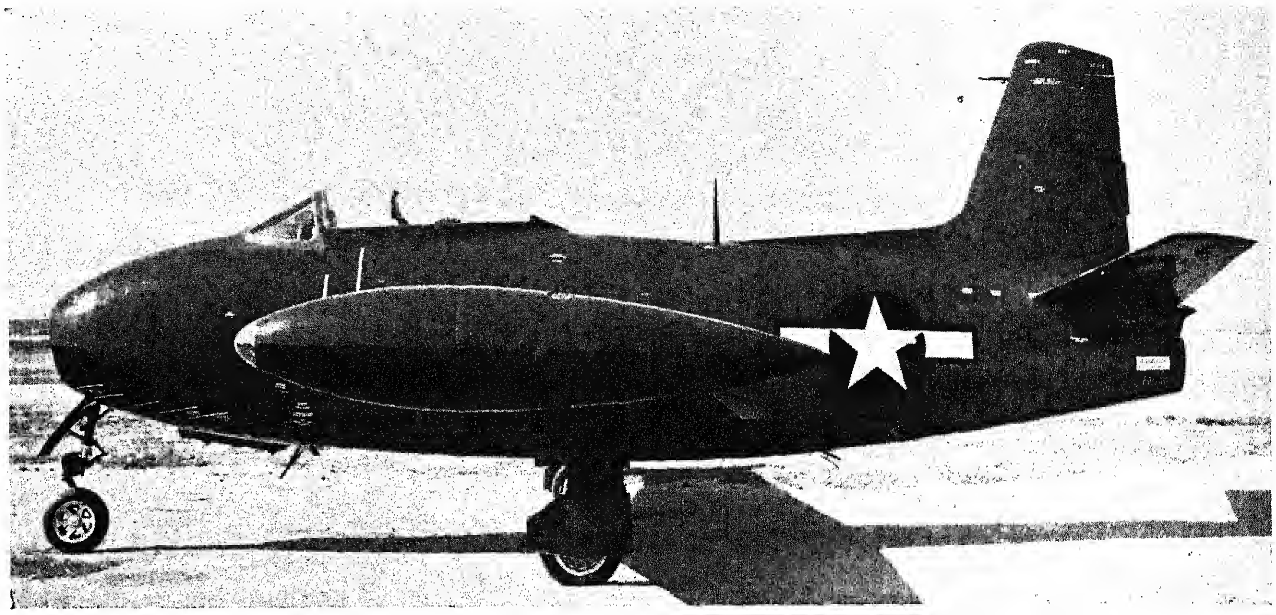
Weights and Loadings.—Weight empty 1,551 lbs. (703 kg.), Pilot and three passengers 680 lbs. (308 kg.), Fuel and oil 259 lbs. (118 kg.), Baggage 80 lbs. (36 kg.), Weight loaded 2,570 lbs. (1,165 kg.), Wing loading 13.9 lbs./sq. ft. (67.87 kg./sq. m.), Power loading 13.9 lbs./h.p. (6.29 kg./h.p.).

Performance (Approximate).—Maximum speed 160 m.p.h. (257 km.h.), Cruising speed at 70% power 150 m.p.h. (241 km.h.) at 5,000 ft. (1,525 m.), Most economic cruising speed 115 m.p.h. (185 km.h.) at 51% power at 5,000 ft. (1,525 m.), Landing speed (with flaps) 54 m.p.h. (87 km.h.), Initial rate of climb 830 ft./min. (253 m./min.), Service ceiling 15,600 ft. (4,755 m.), Maximum range at 51% power at 5,000 ft. (1,525 m.) 700 miles (1,126 km.), Take-off run (flaps at 20 degrees) 232 yds. (212 m.), Landing run (flaps down) 202 yds. (185 m.), Fuel consumption 13.2 U.S. gallons/hr. (50 litres/hr.).



The North American XFJ-1 Single-seat Naval Fighter (General Electric TG-180 turbo-jet engine).

NORTH AMERICAN—*continued.*



The North American XFJ-1 Single-seat Naval Fighter (General Electric TG-180 turbo-jet engine).

THE NORTH AMERICAN N.A. 140.

U.S. Army Air Forces designation : XP-86.

The XP-86 is understood to be the U.S.A.A.F. version of the XFJ-1 described below. The designed maximum speed has been reported to be 586 m.p.h. (938 km.h.). No further details are available for publication.

THE NORTH AMERICAN N.A. 134.

U.S. Navy designation : XFJ-1.

The XFJ-1 single-seat naval fighter represents North American's initial entry into the field of jet-propelled military aircraft.

It is a low-wing cantilever monoplane with tricycle landing-gear and 10 degree dihedral tailplane. A single General Electric TG-180 jet engine is located in the fuselage amidships with a straight-ram air duct extending to the nose of the fuselage. With engine, air intake and main fuel tanks located in the fuselage a very thin high-speed laminar-flow wing section is used. Auxiliary droppable fuel tanks are of the wing-tip type.

The XFJ-1 is intended for both carrier and land operations, with catapult take-off for carrier operations.

DIMENSIONS.—Span 38 ft. 1 in. (11.62 m.), Length 33 ft. 7 in. (10.25 m.), Height 14 ft. 6 in. (4.42 m.).

THE NORTH AMERICAN N.A. 130.

U.S. Army Air Forces designation : XB-45.

The XB-45 is a jet-propelled medium bomber monoplane which is under development for the U.S.A.A.F. The power-plant consists of four jet units which are grouped in horizontal pairs, one pair on each side of the fuselage outboard of the tailplane.

The aircraft is a conventional mid-wing monoplane with dihedral tailplane and tricycle landing-gear. No further details are available.

THE NORTH AMERICAN TWIN MUSTANG.

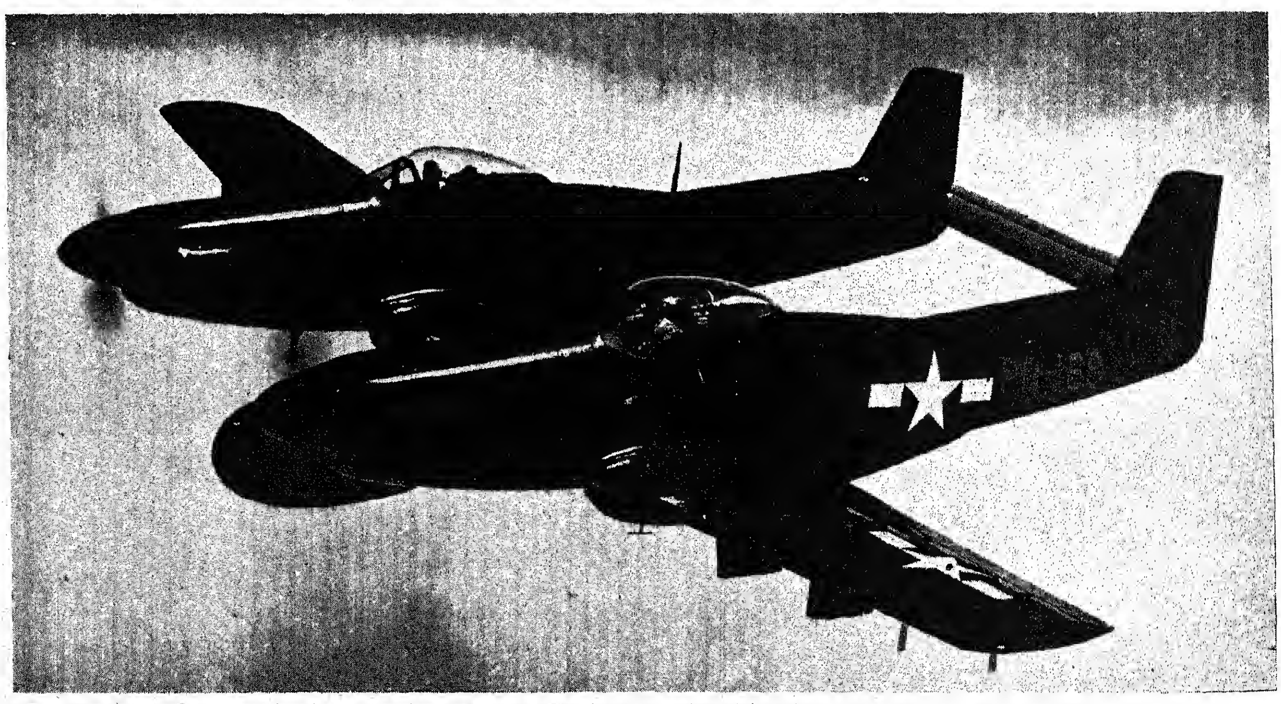
U.S. Army Air Forces designation : P-82.

The P-82 two-seat long-range escort fighter consists virtually of two Mustang fuselages and port and starboard outer wings, the two fuselages being joined together by a constant-chord centre-section and a rectangular tailplane. The P-82 superseded the P-51H at the North American Los Angeles plant when the latter was withdrawn from production in November, 1945.

TYPE.—Twin-engined two-seat long-range Day or Night Fighter or Fighter-Bomber.

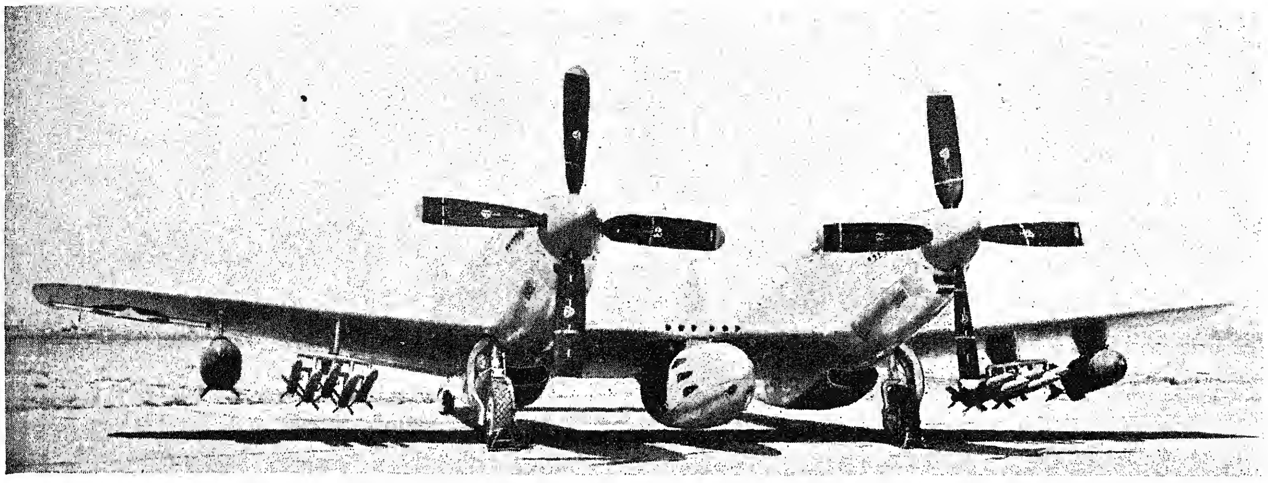
WINGS.—Cantilever low-wing monoplane. Outer wings similar to P-51H except that they attach on the outboard side of each fuselage instead of on the centre-line. Ailerons of increased span with corresponding decrease in span of outer wing flaps. Each aileron constructed in two sections to allow for wing deflection. Controllable trim-tab in inner portion of starboard aileron. Structure of constant-chord centre-section between the fuselages is similar to that of outer wings. Single slotted trailing-edge flap over full span of centre-section. Inter-spar gun-bay and fuel tanks in outboard ends. Heated-surface anti-icing. Gross wing area 408 sq. ft. (37.9 sq. m.).

FUSELAGES.—Similar to P-51H, except that each fuselage is lengthened by an additional section with integral dorsal fin inserted in front of the tailplane.



The North American P-82-B Twin Mustang Night Fighter (two Packard V-1650 engines).

NORTH AMERICAN—*continued.*



The North American P-82 Twin Mustang Fighter-Bomber. This photograph shows some of the stores that may be carried.

TAIL UNIT.—Single-fin and rudder at extremity of each fuselage. Constant-chord tailplane between fins with single main spar, pressed ribs, spanwise stringers and stressed metal covering. One-piece constant-chord elevator with controllable trim-tab. Metal covering. Tailplane span (centre-line of each fin) 14 ft. 4 in. (4.37 m.), Rudder height 7 ft. 0½ in. (2.15 m.).

LANDING GEAR.—Retractable type. Each main wheel is carried in half-fork on shock-absorber leg attached to front spar under outboard side of each fuselage and retracts inwards under fuselage and wing, formed metal fairings enclosing the gear in the retraced position. Hydraulic operation, with emergency mechanical gear. Main gear held in extended position by spring-toggle linkage side-braces and in retracted position by the fairing doors. Track 16 ft. 8¾ in. (5.1 m.). Twin retractable tail-wheels, one in each fuselage and cable operated from main gear, retract into fuselage and are enclosed by twin doors. Both tail-wheels steered by rudder bar, or are disengaged so as to swivel freely when control column is pushed forward.

POWER PLANT.—Two Packard V-1650-9 Merlin twelve-cylinder Vee liquid-cooled engines mounted as in P-51H, and employing water injection. Two-speed two-stage superchargers and Simmonds manifold pressure regulator. Aeroproducts four-blade oppositely rotating full-feathering constant-speed airscrews, 11 ft. 0 in. (3.35 m.) diameter, port airscrew rotating L.H. and starboard airscrew R.H. Ground clearance (tail up) 11$\frac{7}{16}$ in. (29 c/m.). Fuel tanks in outer ends of centre-section and in inner sections of outer wings. Provision for long-range tanks under outer wings and/or centre-section according to stores carried.

ACCOMMODATION.—Twin cockpits, one in each fuselage as on P-51H, with dual controls. Pilot in port and co-pilot or, in case of night fighter, radar operator in starboard. Rudder pedals in either fuselage can be disconnected and stowed. Individual cockpit heating, oxygen, etc. Automatic pilot in port cockpit, with manual emergency release in starboard.

ARMAMENT.—Six .5-in. (12.7 m/m.) machine-guns in centre-section firing between airscrew discs. Provision for four-1,000 lbs. (454 kg) bombs, one under each outer wing and two under centre-section, or two 2,000 lbs. (907 kg) bombs under centre-section. Alternatively, five racks each carrying a cluster of five rocket projectiles can be carried, two under each outer wing and one under centre-section. Streamline nacelle mounting eight .5-in. (12.7 m/m.) machine-guns, with alternative provision for photographic reconnaissance cameras or night-fighting radar, can be installed under centre-section midway between fuselages.

DIMENSIONS.—Span 51 ft. 2.8 in. (15.61 m.), Length (tail up) 39 ft. 0$\frac{3}{16}$ in. (11.88 m.), Height 13 ft. 8 in. (4.16 m.).

WEIGHTS AND LOADINGS.—Weight empty 14,350 lbs. (6,509 kg.), Weight loaded (with maximum internal fuel, 2 crew, ammunition and four 1,000 lbs.=454 kg. bombs) 20,000 lbs. (9,072 kg.), Wing loading 49 lbs./sq. ft. (239 kg./sq. m.).

PERFORMANCE.—Maximum speed, over 475 m.p.h. (764 km.h.), Ceiling 45,000 ft. (13,715 m.), Normal range, over 2,500 miles (4,025 km.), Maximum ferrying range, over 3,000 miles (4,230 km.).

THE NORTH AMERICAN MUSTANG.

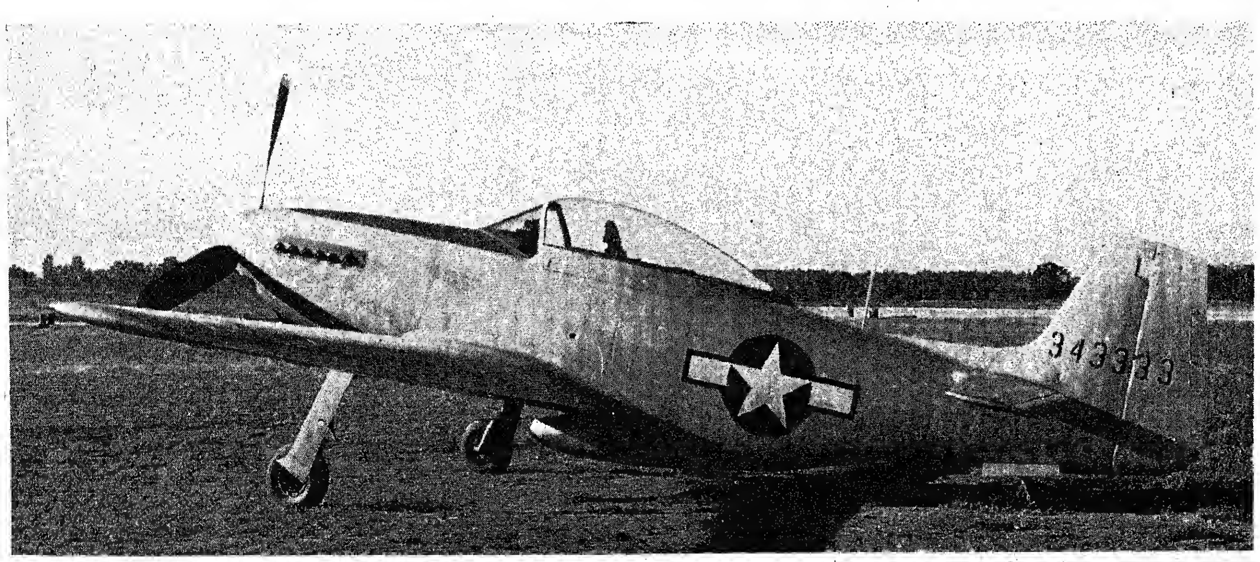
U.S. Army Air Forces designation : P-51.

The original N.A. 73 Mustang was designed and built to a British specification and order. The prototype was actually designed, built and flown in 100 days, its first flight taking place in October, 1940. Passing all tests satisfactorily it was put into production before the end of 1940. The first production Mustang I was delivered to the R.A.F. in Great Britain in November, 1941.

From the Mk. I Mustang, later adopted by the U.S. Army as the P-51, were developed a notable series of fighter aircraft, the many versions of which were detailed fairly fully in the last issue of this Annual. The last version to be widely-used in combat was the P-51D (Mustang IV) which was in production up to VJ-Day.

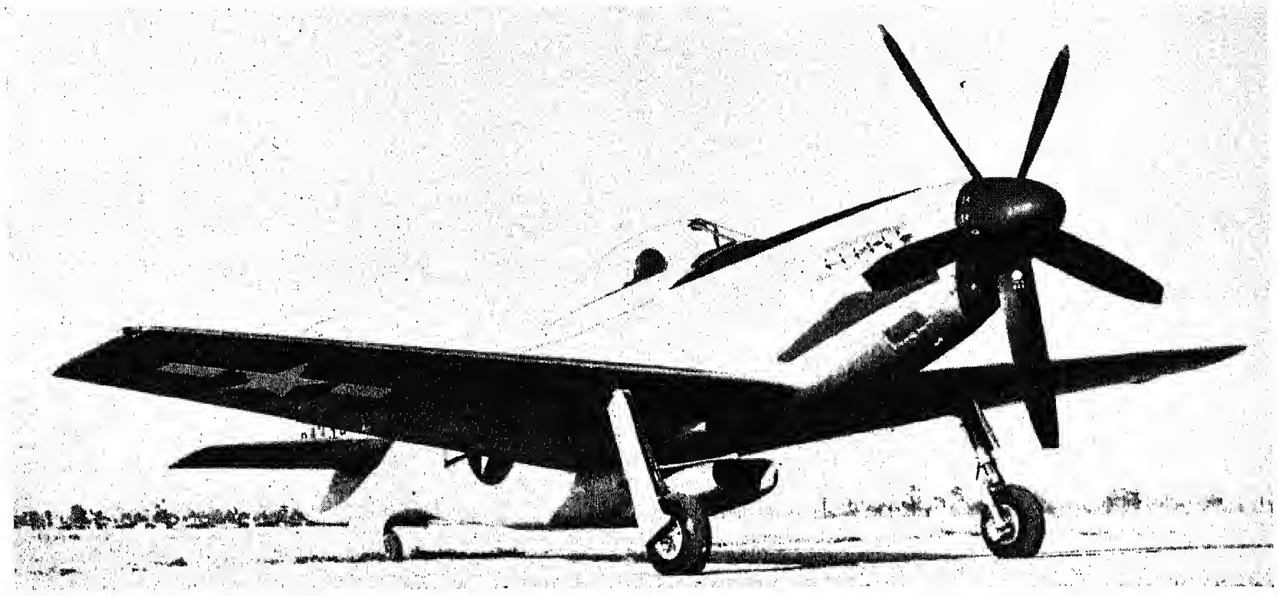
Also in production at that time and until November, 1945, was the P-51H, a lightened version of the Mustang which was virtually a completely new design. It was preceded by two interesting experimental types, the first of which, the XP-51F, was designed as a short-range interceptor. It had a new low-drag laminar-flow aerofoil section, improved fuselage and radiator fairing contours, lightened engine mounting and a lightened landing-gear employing wheels of smaller diameter which allowed them to be retracted into the wing ahead of the front spar without the necessity of increasing the root chord as on earlier Mustangs. Other improvements included the substitution of a heat exchanger for the oil radiator, simplified hydraulic system and cockpit lay-out, etc. The weight of the structure was, as a result, reduced by 1,600 lbs. (726 kg.), and no single structural component was interchangeable with the earlier P-51s. The armament was reduced to four .5-in. (12.7 m/m.) machine-guns, and the petrol capacity was also decreased.

The need for an interceptor having disappeared, a second modification, or XP-51G, was developed for long-range escort fighter duties. A 1,500 h.p. Rolls-Royce Merlin 145 engine was installed, which increased the fuselage length by 12 inches



The North American XP-51F Mustang Experimental Short-range Intercepter Fighter (Packard V-1650-7 engine).

NORTH AMERICAN—*continued.*



The North American XP-51G Mustang Experimental Long-range Escort Fighter (Rolls-Royce Merlin 145 engine and five-blade airscrew).

(30.3 c/m.), and the areas and aspect ratio of the tail-unit were increased. The fuel capacity was increased by the addition of an extra tank behind the pilot, and six .5 in. (12.7 m/m.) guns were installed.

The production version of this aircraft was designated P-51H. It was further improved by the installation of the Packard V-1650-11 Merlin using water-injection and 150 Grade fuel. With additional equipment the P-51H was still 700 lbs. (315 kg.) lighter than the P-51D.

The following specification applies to the P-51H, which was in production until November, 1945.

TYPE.—Single-seat Fighter or Fighter-Bomber.

WINGS.—Cantilever low-wing monoplane. NAA-NACA low-drag laminar-flow aerofoil section. Incidence 1 degree; dihedral 5 degrees; root chord (on fuselage centre-line) 9 ft. 8 in. (2.87 m.), mean aerodynamic chord 6 ft. 10.17 in. (2.1 m.); tip chord 4 ft. 2 in. (1.27 m.). All-metal two-spar structure in two main sections bolted together on the fuselage centre-line. Detachable tips. Inner portion of spars are of I-section composed of two channel-sections, tapering to single channel-section outboard of flaps. Outer portions have flanged lightening holes. Pressed channel-section ribs with lightening holes and stressed-skin covering. Inner sections between spars contain fuel tanks and have top-hat section chordwise stiffeners on top and bottom surfaces. Inter-spar gun-bay outboard of tanks with channel-section chordwise stiffeners on lower surface. Heavy rib between tanks and gun-bay to which landing-gear is attached. Ammunition bay outboard of gun-bay. Gross wing area 235 sq. ft. (21.82 sq. m.). Metal-covered ailerons with trim-tab in port. Aileron area (each) 6.35 sq. ft. (0.57 sq. m.); aileron movement 15 degrees up, 15 degrees down. Tab area 0.71 sq. ft. (0.06 sq. m.), tab movement 10 degrees up, 10 degrees down. Hydraulically-operated slotted trailing-edge flaps between ailerons and fuselage. Flap area (total) 31.74 sq. ft. (2.94 sq. m.), flap depression 45 degrees.

FUSELAGE.—Oval-section all-metal semi-monocoque structure in three main sections consisting of engine section; main fuselage section from engine bulkhead to leading-edge of fin, and rear section. Structure consists of two sides with separate top and bottom. Each side beam consists of two aluminium-alloy longerons (channel-section in front of cockpit tapering to L-section aft) which form the caps, and the aluminium-alloy skin reinforced by vertical channel-section frames forming the webs. L-section longitudinal stringers in main section to aft of cockpit. Radiator tunnel is channel-section structure attaching under and forming lower portion of main fuselage.

TAIL UNIT.—Cantilever monoplane type. One-piece tailplane with detachable tips. Structure of tailplane and fin consists of two channel-section spars, pressed ribs, L-section stringers and stressed metal skin. Fin offset 1 degree to port. Rudder and elevators with sealed dynamic balances and controllable trim-tab in each. Tailplane span 14 ft. 10.16 in. (4.56 m.), tailplane area (including fuselage) 35.50 sq. ft. (3.3 sq. m.). Fin area 14.80 sq. ft. (1.38 sq. m.), Maximum rudder chord 2 ft. 0 in. (0.61 m.), rudder area 10.24 sq. ft. (0.95 sq. m.), rudder movement 30 degrees each way, rudder tab area 0.74 sq. ft. (0.06 sq. m.), tab movement 10 degrees each way. Elevator area (total) 18.25 sq. ft. (1.7 sq. m.), elevator movement 25 degrees up, 25 degrees down, elevator tab area (each) 0.72 sq. ft. (0.06 sq. m.), tab movement 10 degrees up, 25 degrees down.

LANDING GEAR.—Retractable two-wheel type. Each main wheel, on oleo-pneumatic shock-absorber leg hinged on heavy rib outboard of gun-bay, retracts inwards into wing ahead of front spar and is enclosed by light metal plates bolted to legs and by hinged doors under fuselage. Main legs have travel of 8 inches (20.3 c/m.). Hydraulic operation. Track 11 ft. 0 in. (3.35 m.). Goodyear hydraulic brakes. Steerable tail-wheel with multi-tread tyre retracts forward into fuselage and is enclosed by twin resin-bonded plastic fabric doors. Cable-retraction from main gear. Leg travel 7.9 inches (20.06 c/m.).

POWER PLANT.—One Packard-built Rolls-Royce Merlin V-1650-11 twelve-cylinder vee liquid-cooled direct-injection engine rated at 1,380 h.p. at 3,000 r.p.m. at sea-level for take-off and with a normal output of 1,100 h.p. at 2,700 r.p.m. at 17,500 ft. (5,335 m.) and a maximum (war emergency) output of 2,270 h.p. with water injection at 3,000 r.p.m. at 4,000 ft. (1,220 m.). Two-speed two-stage automatic supercharger. Light-weight engine-mounting with outer plate of each side beam flush with outer surface of cowling. Complete power-plant removable forward of firewall. Spot-welded

The North American P-51H Mustang Single-seat Fighter (Packard V-1650-11 engine).—(*William T. Larkins*).

NORTH AMERICAN—*continued.*

cowling of 20 s.w.g. aluminium-alloy attached by Dzus fasteners. Aeroproducts four-blade constant-speed hollow steel paddle-blade airscrew, 11 ft. 0 in. (3.35 m.) diameter; ground clearance (tail up) 9 in. (23 c/m.). Jet-type exhaust pipes. Collapsible non-metallic self-sealing fuel tanks in wings and fuselage; 105 U.S. gallon (397 litre) tank in port wing; 100 U.S. gallon (378 litre) tank in starboard wing and 50 U.S gallon (189 litre) tank in fuselage behind cockpit. Wing-tanks removable through rear spar after flaps removed. Two long-range drop-tanks each of 75 U.S. gallons (284 litres) or 110 U.S. gallons (417 litres) capacity can be carried under wings. Maximum fuel capacity 475 U.S. gallons (1,798 litres) Harrison heat-exchanger oil-cooling system.

Accommodation.—Pilot's enclosed cockpit with 1½ in. (38 m/m.) laminated plate-glass windshield, and long moulded and laminated bubble canopy which slides backwards for access. Hydraulically-adjustable seat. ¼ in. (6.35 m/m.) armour-plating on engine bulhead; $\frac{5}{16}$ in. (7.9 m/m.) plating forming back of seat, and $\frac{7}{16}$ in. (11 m/m.) armour plating for head and neck protection. Thermostatically-controlled combustion-type gasoline cockpit heater producing 15,000 B.T.U. per hr. Pressure demand oxygen system positive up to 30,000 ft. (9,145 m.).

Armament.—Six .5 in. (12.7 m/m.) M-2 machine-guns mounted three in each wing outboard of airscrew disc, with 400 rounds for each inner gun, and 270 rounds for each middle and outer gun. Compensating gun-sight. Access doors to gun and ammunition boxes in upper surface of wing. Provision for ten 5 in. (12.7 c/m.) rocket projectiles; two bombs up to 1,000 lb. (454 kg.) each, or two AN-M-10 chemical smoke tanks under wings.

Equipment.—Radio equipment consists of AN/ARC/3 Command set; SCR-695-A Identification set and BC-1206 Range Receiver set. AN/APS-13 rear detection radar set. MN-26C radio compass optional. AN-N6 camera gun in port wing leading-edge. For photographic reconnaissance duties the following alternative electrically-operated cameras can be installed in fuselage immediately ahead of tailplane: Type K-17 or K-22 with 6 in., 12 in. or 24 in. (15 c/m., 30.5 c/m. or 61 c/m.) lenses for operating at 5,000 ft., 15,000 ft. or 30,000 ft. (1,525 m., 4,572 m., or 9,145 m.) respectively. Type K-24 with 7-in (17.8 c/m.) lens for vertical or oblique photography for operation up to 10,000 ft. (3,050 m.). Hydraulic system operating at 1,500 lbs./sq. in. (105 kg./sq. c/m.).

Dimensions.—Span 37 ft. 0$\frac{5}{16}$ in. (11.27 m.), Length 33 ft. 4 in. (10.15 m.).

Weights and Loadings (Interceptor).—Weight empty 6,500 lbs. (2,948 kg.), Disposable load 1,950 lbs. (884 kg.), Weight loaded 8,450 lbs. (3,832 kg.), Wing loading 36 lbs./sq. ft. (185.8 kg./sq. m.), Power loading (normal) 7.7 lbs./h.p. (3.48 kg./h.p.).

Weights and Loadings (Long-range fighter).—Weight empty 6,500 lbs. (2,948 kg.), Disposable load 3,000 lbs. (1,361 kg.), Weight loaded 9,500 lbs. (4,309 kg.), Wing loading 40.5 lbs./sq. ft. (197.7 kg./sq. m.), Power loading (normal) 8.64 lbs./h.p. (3.9 kg./h.p.).

Weights and Loadings (Fighter-Bomber).—Weight empty 6,500 lbs. (2,948 kg.), Disposable load 5,000 lbs. (2,266 kg.), Weight loaded 11,500 lbs. (5,214 kg.), Wing loading 49 lbs./sq. ft. (200 kg./sq. m.), Power loading (normal) 10.5 lbs./h.p. (4.75 kg./h.p.).

Performance (Interceptor).—Maximum speed (at maximum war emergency power) 488 m.p.h. (785 km.h.) at 25,000 ft. (7,720 m.), Maximum speed (normal output) 410 m.p.h. (660 km.h.) at 22,000 ft. (6,705 km.h.), Maximum rate of climb 6,400 ft./min. (1,950 m./min.) at 5,000 ft. (1,525 m.), Normal rate of climb 2,300 ft./min. (700 m./min.) at 17,500 ft. (5,335 m.), Climb (at normal output) to 20,000 ft. (6,095 m.) 8 minutes.

Performance (Long-range Fighter).—Range with maximum fuel (at 307 m.p.h.=494 km.h. at 25,000 ft.=7,720 m., loaded weight 11,054 lbs.=5,014 kg., and with 20 minutes combat allowance) 2,208 miles (3,553 km.).

Performance (Fighter-Bomber).—Maximum speed (with two 500 lb.=227 kg. bombs and loaded weight of 10,570 lbs.=4,794 kg., or with ten 5 in.=12.7 c/m. rocket projectiles and loaded weight of 10,980 lbs.=4,980 kg.) 450 m.p.h. (724 km.h.) at 25,000 ft. (7,720 m.), Maximum range (with two 500 h.p.=227 kg. bombs and loaded weight of 10,570 lbs.=4,794 kg.) 960 miles (1,545 km.).

THE NORTH AMERICAN N.A. 63.

U.S. Army Air Forces designation : XB-28.

The XB-28 was ordered by the U.S. Army Air Forces Materiel Command as part of the experimental programme on the development of pressurised cabins for military aircraft.

It was a twin-engined Medium Bomber monoplane with a tricycle landing-gear, single rudder tail-unit and pressurised crew accommodation fed by a mechanical engine-driven supercharger to maintain a cabin pressure equivalent to that found at 8,000 ft. (2,440 m.) up to a height of 33,000 ft. (10,060 m.). Cabin heating was by auxiliary heaters in the ducting that circulated air through the cabin. To seal the cabin section rubber strips were sandwiched between all riveted joints and a plastic compound was sprayed throughout the interior.

Armament was carried in three two-gun turrets, all placed outside the pressurised area and remotely-controlled from sighting stations within the cabin.

The XB-28 was fitted with two Pratt & Whitney R-2800-27 eighteen-cylinder radial air-cooled engines with turbo-superchargers, one of the engines being responsible for driving the cabin supercharger.

The XB-28, which first flew in 1942, played an important part in the development of the B-29, the first American tactical aircraft incorporating pressurisation to go into operational service.

Dimensions.—Span 72 ft. 7 in. (22.14 m.), Length 56 ft. 5 in. (17.20 m.), Wing area 676 sq. ft. (62.8 sq. m.).

Performance.—Maximum speed 372 m.p.h. (592 km.h.).

THE NORTH AMERICAN TEXAN.

U.S. Army Air Forces designation : AT-6.
U.S. Navy designation : SNJ.
British name : Harvard.

The AT-6 was first produced in 1939 and was similar to and eventually replaced the BC-1A basic combat trainer when the Basic Combat classification was abandoned. The BC-1A was a development of the BC-1 (SNJ-1 and Harvard I). Both were fitted with the Pratt & Whitney R-1340-47 engine, the BC-1 having a steel tube fabric-covered fuselage while the BC-1A had a semi-monocoque rear fuselage and a re-designed tail-unit.

Since then several series of AT-6 Advanced Trainers have been built, the various sub-types varying mainly in matters of equipment. These may be summarised as follows:—

AT-6 (Harvard II). Pratt & Whitney R-1340-47 engine. Integral fuel tanks in centre-section.

AT-6A (SNJ-3). Pratt & Whitney R-1340-49 engine. Removable aluminium fuel tanks. The AT-6A built in Canada under licence by Noorduyn Aviation, Ltd. was the Harvard IIB. Canadian-built Harvards were also delivered to the U.S. Army and because of manufacturing and equipment differences these were given the designation AT-16.

AT-6B. Pratt & Whitney R-1340-AN1 engine. Fitted with four internal wing bomb-racks.

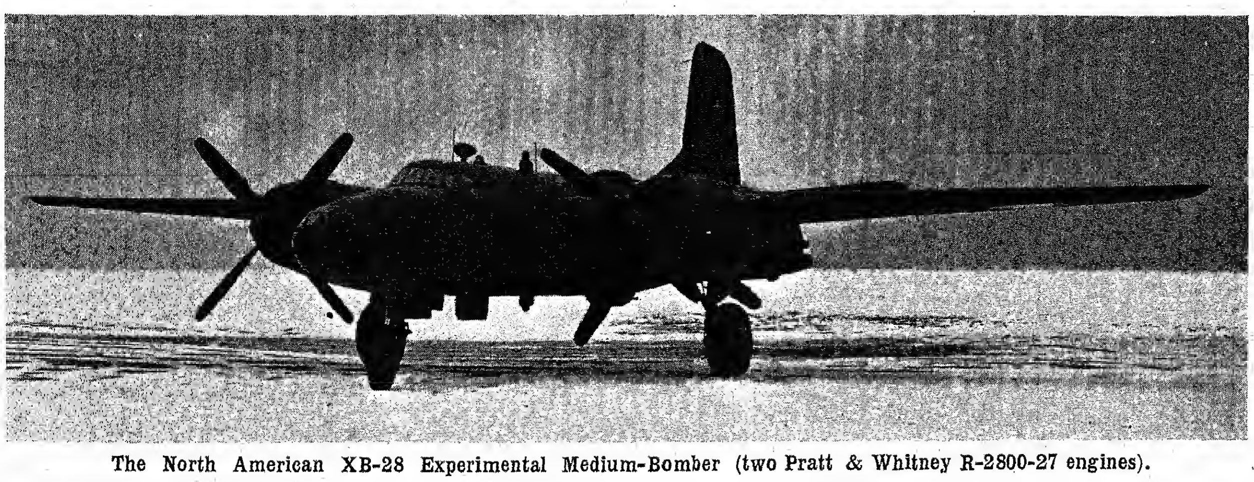
AT-6C (SNJ-4 and Harvard IIA). Pratt & Whitney R-1340-AN1 engine. In 1941, owing to possible shortages in strategic materials, the structure of the AT-6C was re-designed partially to eliminate the use of aluminium-alloy and high-alloy steels. The entire rear fuselage, tailplane, floor boards, etc. were made of plywood. A saving of 220 lbs. (100 kg.) of aluminium-alloy per aircraft was achieved. The standard structure was later reverted to.

AT-6D (SNJ-5 and Harvard III). Pratt & Whitney R-1340-AN1 engine. Standard structure as described below. 24-volt electrical system. No photographic equipment.

AT-6F (SNJ-6). Same power-plant as AT-6D. Strengthened outer wings and redesigned rear fuselage. Only external differences are the addition of an airscrew spinner and a moulded plastic rear section of the canopy in place of the earlier built-up unit.

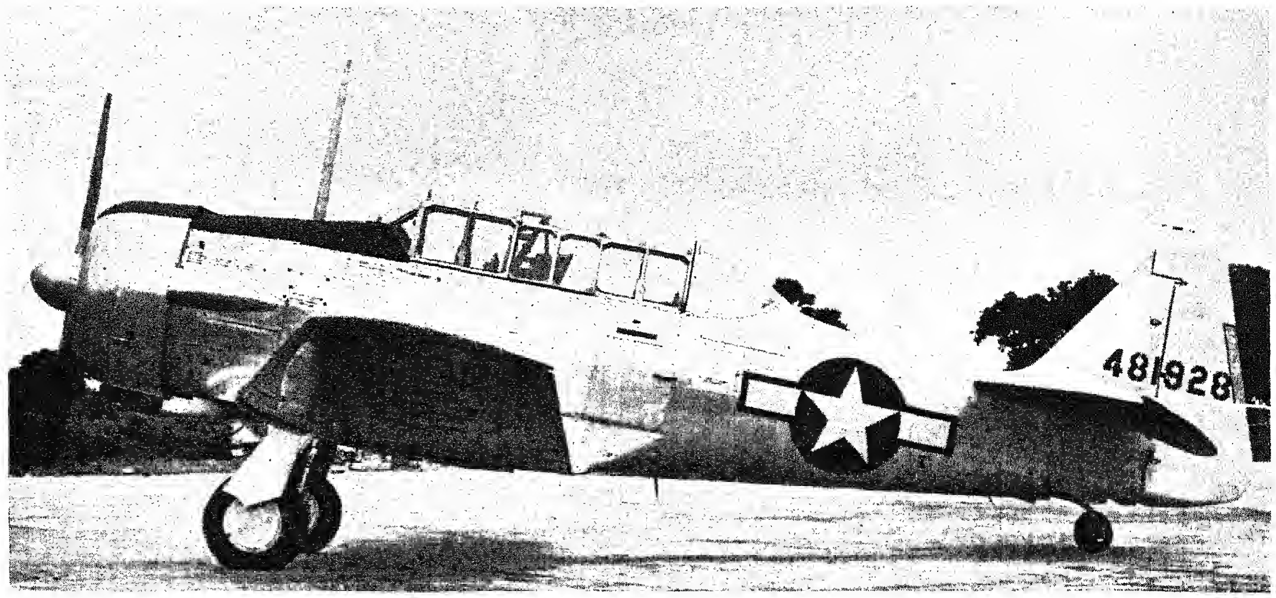
The British Harvard versions of the AT-6 carried no armament and were fitted with British instruments, radio, shoulder harness, etc.

The Texan was in production at Dallas, Texas, right up to VJ-Day and when the Dallas plant closed down a few days after, 15,117 Texans had been built, representing 25.8 per cent. of all trainers built in the United States since July, 1940.



The North American XB-28 Experimental Medium-Bomber (two Pratt & Whitney R-2800-27 engines).

NORTH AMERICAN—*continued.*



The North American AT-6F Texan Two-seat Advanced Trainer (Pratt & Whitney R-1340-AN1 engine).—(*Peter Bowers*).

TYPE.—Two-seat Advanced Training (AT-6) or Scout Training (SNJ) monoplane.

WINGS.—Low-wing cantilever monoplane. Two spar rectangular centre-section and two single-spar tapered outer sections with detachable wing-tips. All-metal structure with aluminium-alloy spars and ribs and a smooth Alclad skin. Aerodynamically and statically-balanced ailerons have metal frames and fabric covering. Split trailing-edge flaps between ailerons. Wing area 253.7 sq. ft. (23.6 sq. m.).

FUSELAGE.—Welded chrome-molybdenum steel-tube structure from fireproof bulkhead to rear cockpit, remainder of aluminium-alloy semi-monocoque construction. Side panels of the forward section are of aluminium-alloy and are removable.

TAIL UNIT.—Cantilever monoplane type. Aluminium-alloy framework, fixed surfaces covered with Alclad sheet and movable surfaces with fabric. Elevators and rudder have trim-tabs controllable from both cockpits.

LANDING GEAR.—Retractable cantilever type, with wheels folding inwards. Retraction by engine-driven hydraulic pump. Hydraulic wheel-brakes. Full-swivelling steerable tail-wheel.

POWER PLANT.—One 550 h.p. Pratt & Whitney R-1340-AN1 radial air-cooled engine. Hamilton Standard two-blade constant-speed airscrew. Fuel tanks (111 U.S. gallons capacity) in centre-section. Oil tank (10.2 U.S. gallons=38.6 litres) in engine compartment.

ACCOMMODATION.—Tandem cockpits with individually-operated sliding enclosures. Complete dual flight and engine controls in each cockpit. Adjustable seat in front cockpit, rotating and adjustable gunner's seat in back cockpit.

ARMAMENT.—One 0.30 in. (7.7 m/m.) machine-gun in starboard side of fuselage forward of pilot's cockpit, one 0.30 in. (7.7 m/m.) machine-gun in leading-edge starboard outer wing, and one 0.30 in. (7.7 m/m.) machine-gun on flexible mounting in rear cockpit.

DIMENSIONS.—Span 42 ft. 0$\frac{1}{4}$ in. (12.9 m.). Length 28 ft. 11$\frac{7}{8}$ in. (8.8 m.), Height 11 ft. 8$\frac{1}{2}$ in. (3.5 m.)

WEIGHTS AND LOADINGS.—Weight empty 4,158 lbs. (1,888 kg.), Disposable load 1,142 lbs. (518 kg.), Normal loaded weight 5,250 lbs. (2,383 kg.), Wing loading 20.8 lbs./sq. ft. (101.5 kg./sq. m.), Power loading 9.6 lbs./h.p. (4.35 kg./h.p.).

PERFORMANCE.—Maximum speed at 5,000 ft. (1,525 m.) 205 m.p.h. (331.2 km.h.), Cruising speed at 5,000 ft. (1,525 m.) 170 m.p.h. (272 km.h.), Landing speed 63 m.p.h. (101 km.h.), Service ceiling 21,500 ft. (6,560 m.), Normal range 750 miles (1,200 km.).

NORTHROP.

NORTHROP AIRCRAFT, INC.

HEAD OFFICE AND WORKS : NORTHROP FIELD, HAWTHORNE, CALIFORNIA.

President and Chief Engineer : John K. Northrop.

General Manager and Chairman of the Board : LaMotte T. Cohu.

Vice-President in Charge of Production : Gage H. Irving.

Vice-President and General Counsel : Graham L. Sterling, Jr.

Vice-President in charge of Sales : Theodore C. Coleman.

Director of Engineering : Walter J. Cerny.

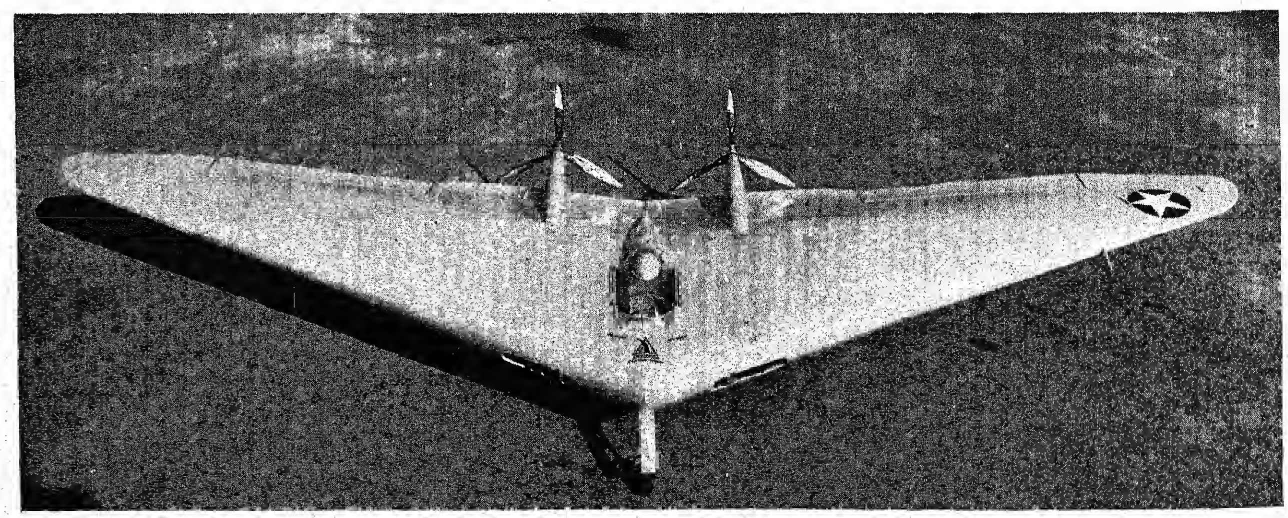
Secretary : Moye W. Stephens.

This concern was formed in 1939 by Mr. John K. Northrop to undertake the manufacture of military aircraft. Mr. Northrop, who has long been associated with the design of high-performance all-metal military aircraft, was latterly associated with the Douglas Aircraft Company. He resigned from the Douglas Company in 1939 to form his new company.

The Company's first contract was for the supply of twenty-four single-engined high-performance Patrol-Bomber seaplanes for the Norwegian Government. These aircraft were delivered early in 1941.

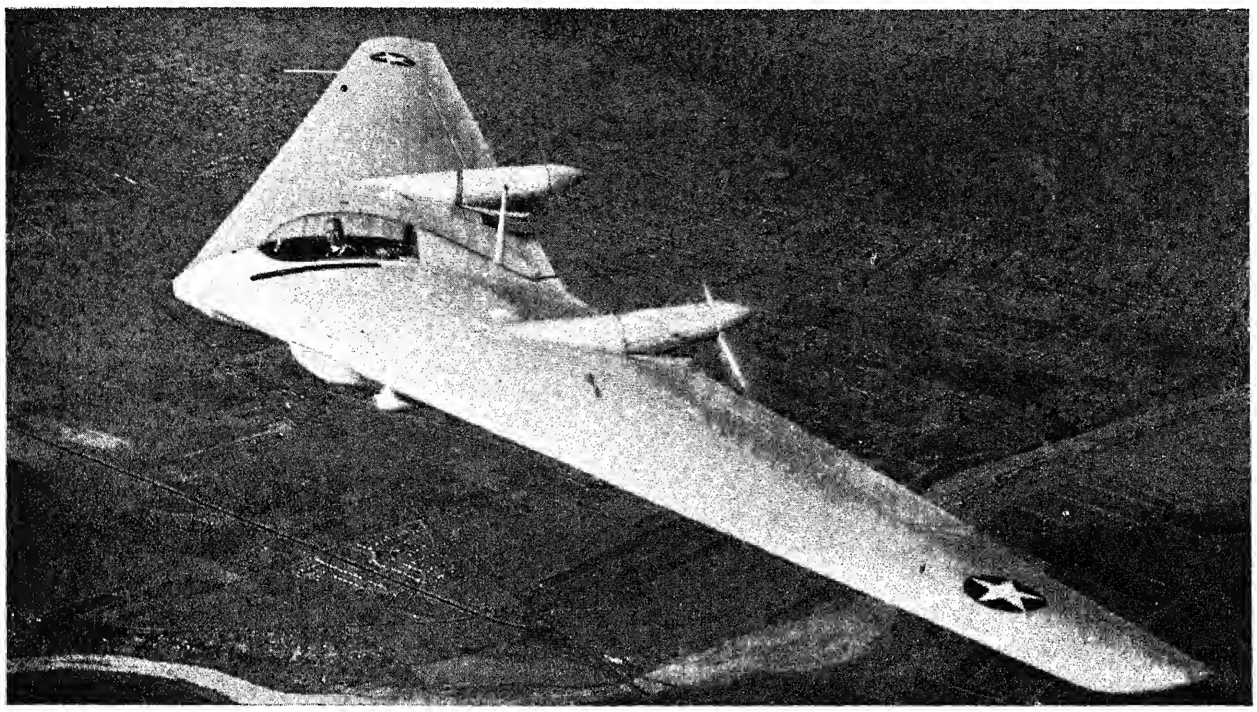
In 1944-45 the Company was in production for the U.S. Army Air Forces with the P-61 Black Widow, the first American aeroplane specifically built as a Night Fighter. Production of this aircraft ceased when the war ended, but a development of it—the F-15 Reporter—is still being manufactured.

Northrop Aircraft, Inc. has devoted considerable attention to the design of the "Flying-Wing" under the guidance of Mr. John K. Northrop, a pioneer in the development of this type of aircraft.



The Northrop N-1M Experimental tail-less Monoplane which first flew in 1940.

NORTHROP—*continued.*



The Northrop N-9M Flight Research Flying-Wing. It was slightly more than one-third the size of the XB-35.

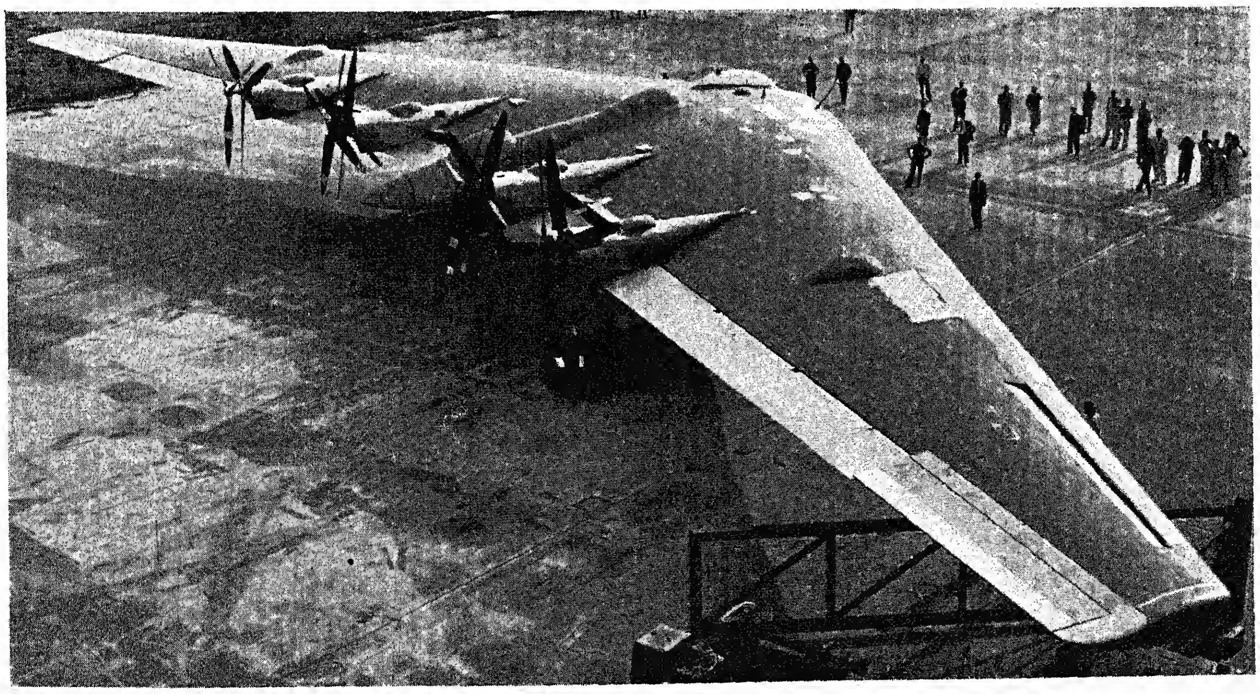
His first practical aeroplane incorporating "flying-wing" features was built by the Avion Corporation of Burbank, California, a company formed by J. K. Northrop and W. K. Kay in 1928. It was a 90 h.p. monoplane with a span of 30 ft. 6 in. (9.29 m.) and carried a conventional tail-unit on twin booms; the pilot was accommodated in a cockpit in the wing, there being no orthodox nacelle.

Various commercial difficulties prevented further immediate development of this aircraft, but in 1939, when Northrop Aircraft, Inc. was formed, development of the tail-less aircraft was resumed.

The first purely all-wing aircraft was known as the N-1M, an illustration of which appeared in the 1941 issue of "All the World's Aircraft." It was powered originally by two 65 h.p. Lycoming engines, but these were later replaced by 120 h.p. Franklins. The N-1M made its first flight at the Muroc Army Air Base in 1940. It had a span of 38 ft. 0 in. (11.58 m.) and a wing area of 300 sq. ft. (27.87 sq. m.).

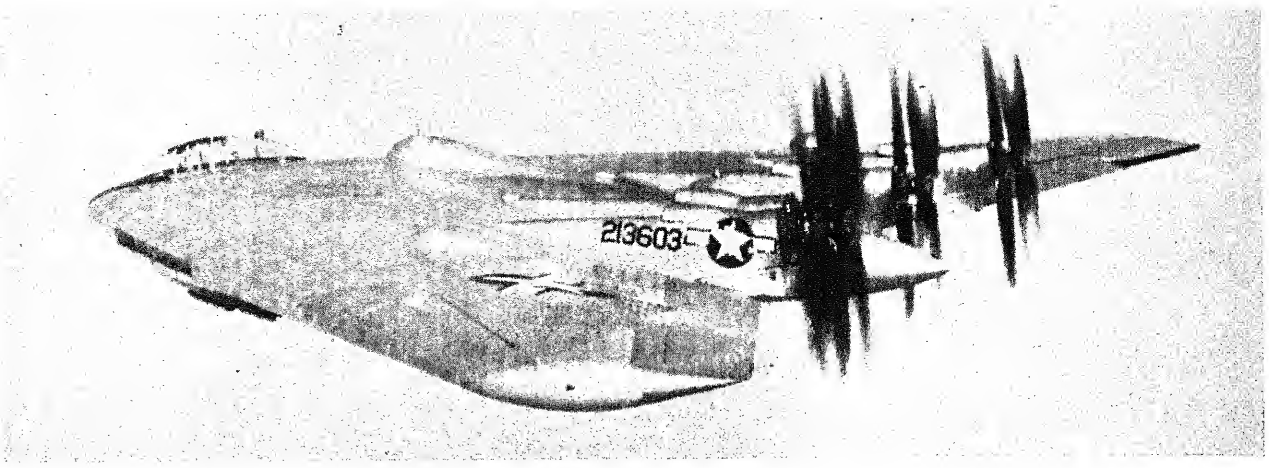
Preliminary layout of a long-range bomber to this formula was submitted to the U.S.A.A.F. in September, 1941, and with the assistance and co-operation of the Wright Field Engineering Division, actual design work began early in 1942. Design of the full-size mock-up was approved in the following July. Owing to the fact that the P-61 Black Widow programme was then occupying all Northrop resources, the Glenn L. Martin Company of Baltimore, which had been awarded a contract (later cancelled) for the production of 200 B-35s, was entrusted with the detail design of the wing and power-plant installation, while the Northrop Company continued with the aerodynamic development, basic stress work, and the design and production of the landing-gear, controls and control surfaces, and all equipment. Later, engineering personnel from the Otis Elevator Company of New York City were called in to complete the structural design of the wing under Northrop and Martin supervision.

Four twin-engined flying scale-models of the XB-35 (roughly one-third size) were built to provide research data. These aircraft, designated N-9M, had a span of 60 ft. 0 in. (18.29 m.). The first two were powered by 275 h.p. Menasco engines, as was the third (the N-9M-A), but the fourth aircraft, the N-9M-B,



The Northrop XB-35 Flying-Wing Bomber (four Pratt & Whitney R-4360 Wasp-Major engines).

***NORTHROP**—continued.*



The Northrop XB-35 Flying-Wing Bomber (four Pratt & Whitney R-4360 engines).

had two 300 h.p. Franklin engines. The loaded weight of each was 7,100 lb. (3,221 kg.).

Production of the prototype XB-35 began at the Northrop plant at Hawthorne early in 1943. It was completed in 1946, and the first flight was made on June 25, 1946, from Hawthorne, Cal., to Muroc where the aircraft has been going through its trials. Fifteen development aircraft, designated YB-35, have been ordered by the U.S.A.A.F.

Other military "flying-wing" designs produced during the war, include the XP-56 single-seat fighter, illustrated in the last issue of this Annual, and the XP-79, a tail-less fighter, fitted with two Westinghouse 19B jet units and with the pilot lying in a prone position.

The Company has under development a jet-propelled version of the XB-35 carrying the Army designation XB-49, and a three-engined civil freight-carrying monoplane named the Pioneer.

THE NORTHROP XB-49.

The XB-49 is a jet-propelled version of the XB-35 which is now under development. Eight General Electric TG-180 jet units are mounted in two groups of four, one group on each side of the central nacelle. Vertical fin area has been added on each side of each group to offset the absence of propellers. In most other respects the XB-35 and XB-49 are identical, the XB-35 airframe being used for the conversion.

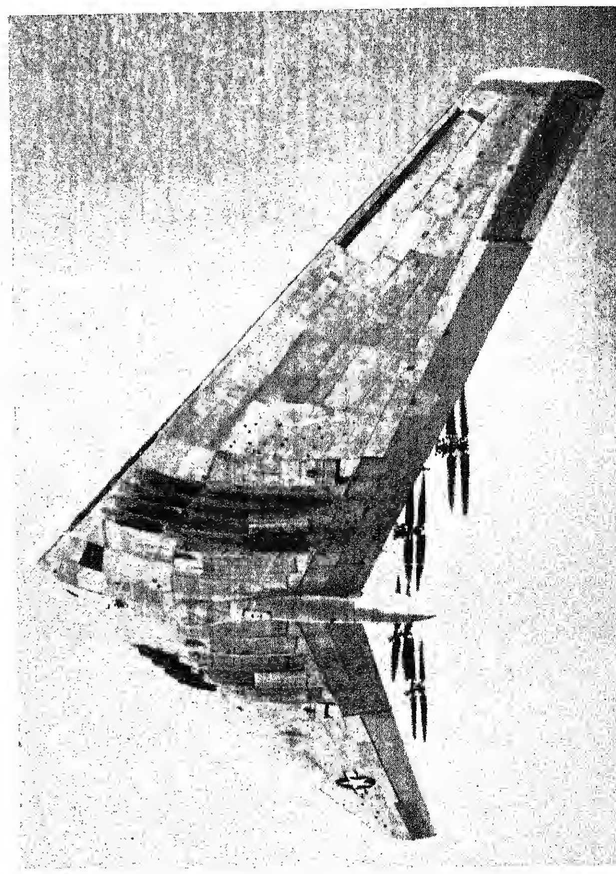
THE NORTHROP XB-35.

Type.—Four-engined Long-range "Flying-Wing" Heavy Bomber.

Wings.—Cantilever wing of aluminium-alloy constructed in one piece, straight-tapered and swept-back. Maximum chord (on centre-line) 37 ft. 6 in. (11.43 m.), Tip chord 9 ft. 4 in. (2.84 m.), Gross wing area 4,000 sq. ft. (371.6 sq. m.). Drag-inducing double-split flaps at wing-tips for directional control, and "elevons," performing function of elevators and ailerons, between them and outer engines. "Elevon" span 34 ft. 6 in. (10.51 m.). Split trailing-edge flaps between outer engines and crew nacelle. Flap span (approximate) 29 ft. 0 in. (8.84 m.), Chord (approximate) 6 ft. 0 in. (1.83 m.), Flap area (each—approximate) 175 sq. ft. (15.79 sq.m.). All control surfaces assisted by full-boost hydraulic system. Fixed wing-tip slots in leading-edge, which open only at speeds approaching the stall.

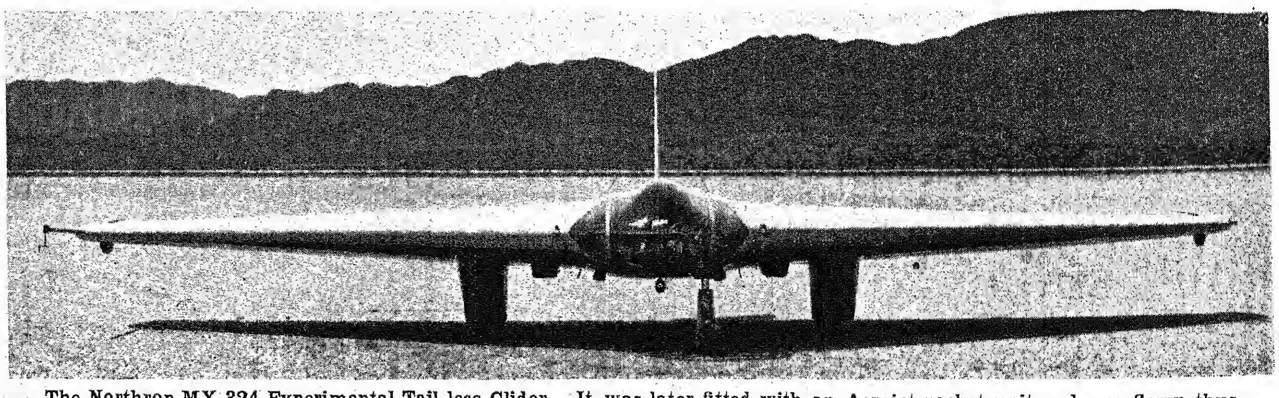
Nacelle.—Monocoque aluminium-alloy structure built around centre-line of wing for crew accommodation.

Landing Gear.—Retractable tricycle type. Each main unit consisting of twin wheels 5 ft. 6 in. (1.68 m.) diameter carried on single shock-absorber leg with side and rear link members, retracts forward into wing between inner and outer engines. Single nose-wheel 4 ft. 8 in. (1.42 m.) diameter retracts backwards into central nacelle. Electric operation.

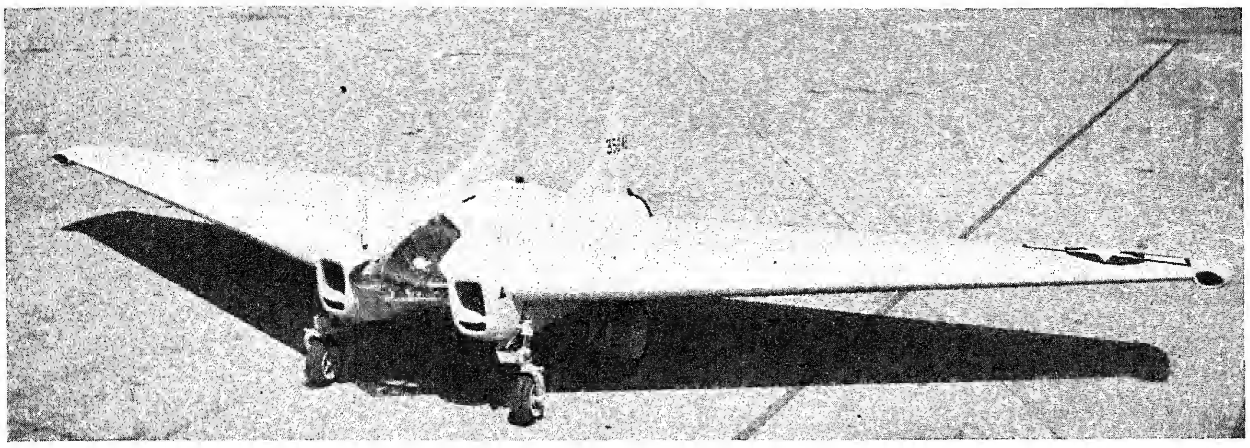


The Northrop XB-35 Flying-Wing.

Power Plant.—Four Pratt & Whitney Wasp-Major (two R-4360-17 and two R-4360-21) twenty-eight-cylinder four-row radial air-cooled engines, normal output (each) 2,500 h.p. at rated altitude and with military output (each) of 3,000 h.p., mounted in the



The Northrop MX-324 Experimental Tail-less Glider. It was later fitted with an Aerojet rocket unit and was flown thus, reaching a speed of about 350 m.p.h. (560 km.h.).



The Northrop XP-79B Experimental Tail-less Jet-propelled Fighter in which the pilot lies prone.

wings and driving Hamilton-Standard eight-blade counter-rotating co-axial reversible-pitch pusher propellers, 15 ft. 4 in. (4.67 m.) diameter, through extension shafts and gear boxes. Two single-stage General Electric turbo-superchargers to each engine. Leak-proof fuel tanks in wings. Duct in leading-edge of wing extending in front of engines directs cooling air to engines, superchargers, inter-coolers and oil-coolers *via* plenum chambers where forward motion of aircraft builds up pressure.

ACCOMMODATION.—Normal crew of nine, pilot, co-pilot, bombardier, navigator, engineer, radio-operator and three gunners, with folding bunks for six reserve members, in pressurized central nacelle. Pilot situated in forward cockpit offset to port with bubble canopy, and bombardier on starboard with bombing windows in leading-edge.

ARMAMENT.—Two electrically-operated four-gun turrets, one above and one below wing, offset to starboard of wing centre-line, and four electrically-operated remotely-controlled two-gun turrets, one above and one below each wing between outer engines and wing-tips. Fire-control blister towards end of central nacelle.

EQUIPMENT.—Eight hydraulic pumps, absorbing 92 h.p., provide power for control boost and servo systems. 400-cycle 3-phase 208-volt A.C. electrical system. Minneapolis-Honeywell automatic pilot employing four servo motors.

DIMENSIONS.—Span 172 ft. 0 in. (52.43 m.), Length overall 53 ft. 1 in. (16.18 m.), Height overall 20 ft. 1 in. (6.12 m.).

WEIGHTS AND LOADINGS (Designed).—Weight empty 89,000 lbs. (40,424 kg.), Useful load 73,000 lbs. (33,113 kg.), Weight loaded 162,000 lbs. (73,482 kg.), Maximum overload weight 209,000 lbs. (94,800 kg.), Wing loading (at normal loaded weight) 40.5 lbs./sq. ft. (197.74 kg./sq. m.), Power loading (at normal loaded weight, 3,000 h.p. per engine) 13.5 lbs./h.p. (6.12 kg./h.p.).

PERFORMANCE.—No data available.

THE NORTHROP XP-89.

The XP-89 is a single-seat single-jet fighter monoplane which is under development for the U.S.A.A.F. No details of this aircraft were available for publication at the time of closing for press.

THE NORTHROP MX-324.

The MX-324 was built as a tail-less glider with the pilot in a prone position to provide data for the development of the XP-79 fighter. Later it was fitted with an Aerojet XCAL-200 rocket unit which could develop a thrust of 200 lbs. (90.8 kg.) for five minutes. On July 5, 1944, the MX-324 was towed to 8,000 ft. (2,440 m.) by a Lockheed Lightning and cast off to become the first aircraft to make a sustained flight by rocket power. A maximum speed of about 350 m.p.h. (560 km.h.) was reached.

THE NORTHROP XP-79B.

The XP-79B is an experimental "flying-wing" type tail-less jet-propelled fighter monoplane. The pilot lies prone in a cockpit on the centre-line and on each side of the cockpit is a Westinghouse 19-B gas turbine engine which exhausts over the trailing-edge of the wing. Twin fins spring from the tops of the engine fairings. Bellows-operated split horizontal control surfaces are located on the outer wings, air for their actuation being diverted by control valves in tunnel ducts which form the wing-tips. Trailing-edge flaps are located between the bellows-operated surfaces and the engine nacelles. The aircraft is constructed mainly of welded magnesium.

THE NORTHROP PIONEER.

TYPE.—Three-engined Cargo or Passenger Transport.

WINGS.—Cantilever high-wing monoplane. Two-spar multi-cellular stressed-skin structure in three main sections consisting of constant-chord centre-section carrying port and starboard engine nacelles and two tapered outer wings. Detachable tips. Leading-edge hinged for access to controls. Dihedral 2 degrees: incidence $5\frac{1}{2}$ degrees. Root chord 15 ft. 6 in. (4.72 m.); mean aerodynamic chord 13 ft. 7 in. (4.14 m.); tip chord 8 ft. 7 in. (2.61 m.); centre-section span 30 ft. (9.14 m.); wing area 1,100 sq. ft. (102.19 sq. m.), Northrop retractable ailerons on outer wings, with trim-tab in port. Aileron span 3 ft. 6.36 in. (1.07 m.). Hydraulically-operated split trailing-edge flaps between ailerons and fuselage. Flap root chord 4 ft. 0.89 in. (1.22 m.); flap tip chord 2 ft. 2.49 in. (0.67 m.).

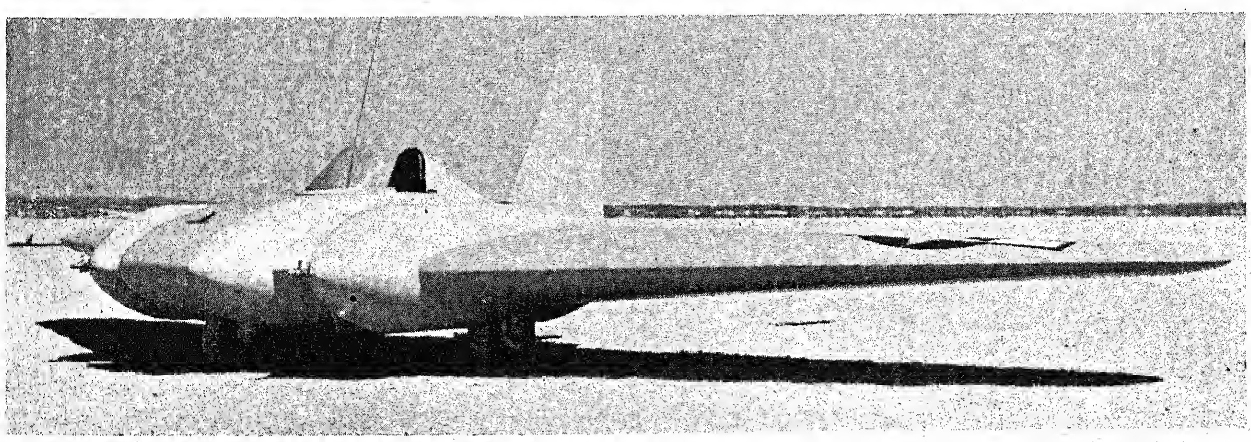
FUSELAGE.—All-metal structure of circular cross-section. Maximum diameter 10 ft. (3.05 m.).

TAIL UNIT.—Cantilever monoplane type. Statically-balanced rudder and elevators with trim-tab in each. Tailplane span 32 ft. 6 in. (9.90 m.); maximum chord (on fuselage centre-line) 9 ft. 7 in. (2.92 m.); tip chord 4 ft. 8 in. (1.42 m.); fin height 13 ft. 4 in. (4.06 m.).

LANDING GEAR.—Fixed two-wheel type. Main wheels each carried on long-travel oleo shock-absorber leg extending downwards from engine nacelle and braced to fuselage by horizontal V-struts. Fixed tail-wheel on shock-absorber leg. Track 21 ft. 3 in. (6.48 m.); wheel base (tail down) 35 ft. 7 in. (10.84 m.).

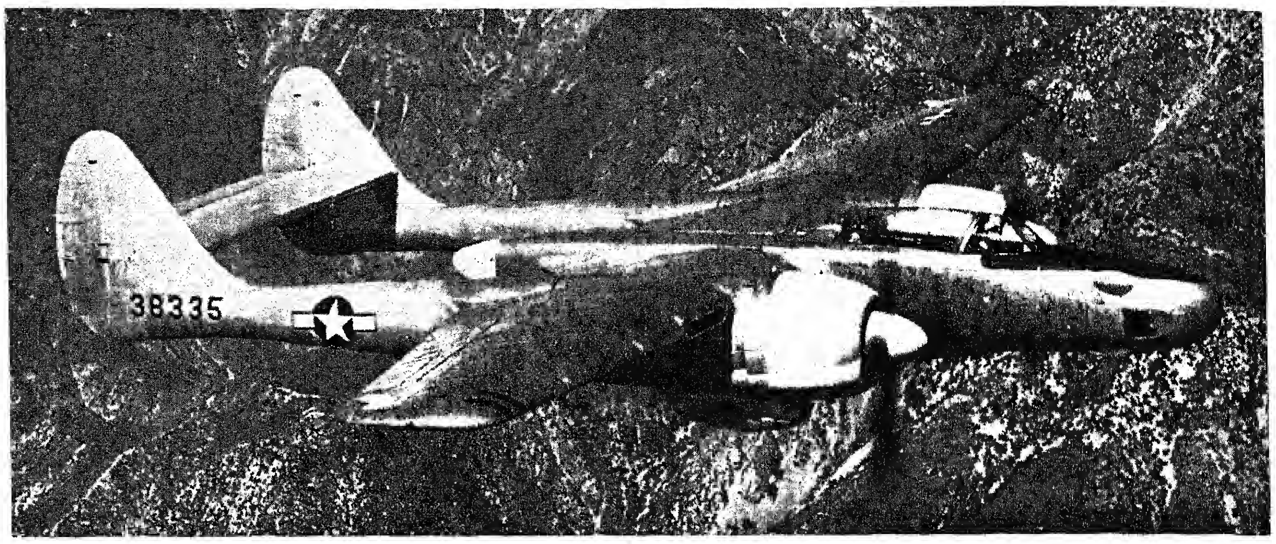
POWER PLANT.—Three Wright 744C7BA1 Cyclone seven-cylinder radial air-cooled engines mounted one in nose and one on each wing, each rated at 600 h.p. METO power and with 800 h.p. available for take-off, or three Pratt & Whitney S3H1 Wasp nine-cylinder radial air-cooled engines each rated at 550 h.p. METO power and with 600 h.p. available for take-off. Engines interchangeable left, right and centre with minor alterations. Two-blade airscrews, 12 ft. (3.66 m.) diameter. Fuel capacity 1,000 U.S. gallons (3,785 litres) in Mareng tanks installed in wings through front spar.

ACCOMMODATION.—Normal crew of two consisting of pilot and co-pilot side-by-side with dual controls in wide enclosed cockpit ahead of wing. Main cabin can be equipped for passenger or freight carriago and is 6 ft. 7 in. (2 m.) high. Maximum internal



The prototype Northrop GB-2 Tail-less Radio-controlled Glider Bomb with pilot's cockpit for controlled gliding tests.

***NORTHROP**—continued.*



The Northrop F-15A Reporter Long-range Photographic-Reconnaissance Monoplane.

width 9 ft. 7 in. (2.92 m.). Passenger access door 6 ft. × 3 ft. 2 in. (1.83 m. × 0.96 m.) at rear of cabin on port side. Door 13 in. (33 c/m. from ground. Cargo-loading door 6 ft. × 5 ft. 10 in. (1.83 m. × 1.78 m.).

DIMENSIONS.—Span 85 ft. 0 in. (25.90 m.), Length 60 ft. 7 in. (18.47 m.), Height (tail down, over rudder) 17 ft. 10 in. (5.44 m.).

WEIGHTS AND LOADINGS.—Disposable load 10,600 lbs. (4,808 kg.), Weight loaded 25,000 lbs. (11,340 kg.), Wing loading 22.72 lbs./sq. ft. (110.86 kg./sq. m.), Power loading (Cyclone engines) 15.6 lbs./h.p. (7.06 kg./h.p.), Power loading (Wasp engines) 20.6 lbs./h.p. (9.34 kg./h.p.).

PERFORMANCE.—Cruising speed 185 m.p.h. (298 km.h.) at 10,000 ft. (3,050 m.), Landing speed (with flaps) 62 m.p.h. (100 km.h.), Service ceiling 21,000 ft. (6,400 m.), One-engine ceiling 15,000 ft. (4,570 m.), Range 1,750 miles (2,816 km.), Take-off run (with 10,600 lbs. = 4,808 kg. payload) 267 yds. (244 m.), Take-off run (with 5,600 lbs. = 2,540 kg. payload) 150 yds. (137 m.), Landing run (fully loaded) 250 yds. (223 m.).

THE NORTHROP REPORTER.

U.S. Army Air Forces designation : F-15A.

The Reporter is a photographic-reconnaissance aircraft developed from the P-61 Black Widow night-fighter which it closely resembles, the chief difference being in the design of the crew nacelle.

Design work began in the early Summer of 1944, the original specification calling for a long-range fighter aircraft to escort bombing formations in the Pacific Theatre under the designation XP-61E. Two prototypes were completed in January and February, 1945, respectively, but as their development proceeded the military situation rendered the long-range escort-fighter aircraft superfluous, and called for a long-range aircraft carrying comprehensive photographic gear. The XP-61E was duly modified for this purpose and re-designated the F-15 Reporter. 175 were ordered for the U.S.A.A.F.

TYPE.—Twin-engined Long-range Photographic-Reconnaissance monoplane.

WINGS.—Cantilever shoulder-wing monoplane. All-metal structure in six sections : two inner and two outer sections bolted together, and detachable tips. Two-spar structure, spars continuing through nacelle. Inner wing panels set at dihedral angle to nacelle. Inner wing section span (each) 9 ft. 6.6 in. (2.91 m.), Chord 11 ft. 11.95 in. (3.66 m.), Depth (from bottom at root to top at extremity) 5 ft. 0 in. (1.52 m.). Outer wing section span (each) 19 ft. 9½ in. (6.03 m.), Chord 12 ft. 0 in. (3.66 m.), Depth 1 ft. 10 in. (.56 m.), Tip span 1 ft. 8 in. (.51 m.). Gross wing area 664 sq. ft. (61.68 sq. m.). Short-span ailerons at wing-tips and four Northrop retractable ailerons acting as spoilers and consisting of perforated scoop-shape strips located near trailing-edge forward of flaps. Full-span trailing-edge flaps in four sections each side of nacelle. Magnesium control rods.

NACELLE AND TAIL BOOMS.—All-metal monocoque nacelle and twin Heliarc-welded magnesium booms extending aft from engine nacelles to carry tail-unit. Nacelle 35 ft. 1.9 in. long × 4 ft. 1.1 in. wide × 6 ft. 5 in. high (10.71 m. × 1.25 m. × 1.96 m.), Tail-booms 9 ft. 0 in. long × 3 ft. 2.1 in. wide × 3 ft. 5.2 in. deep (2.74 m. × .91 m. × .63 m.).

TAIL UNIT.—All-metal twin fins and rudders mounted above ends of tail-booms and connected laterally by constant-chord tailplane and one-piece elevator. Rudders and elevator statically and aerodynamically-balanced. Trim tabs in rudders ; trim and balance tabs in elevator. Fin height 9 ft. 2.2 in. (2.79 m.), Chord 7 ft. 7.6 in. (2.33 m.), Thickness 9 in. (22.86 cm.), Rudder height 9 ft. 0 in. (2.74 m.), Chord 3 ft. 0 in. (.91 m.), Thickness 7.58 in. (19.25 cm.), Tailplane span (net) 16 ft. 8 in. (5.08 m.), tailplane chord 4 ft. 8.9 in. (1.44 m.), Thickness 11 in. (27.94 cm.), Elevator span 16 ft. 8 in. (5.08 m.), Chord 2 ft. 10.1 in. (0.86 m.), Thickness 6.3 in. (16 cm.).

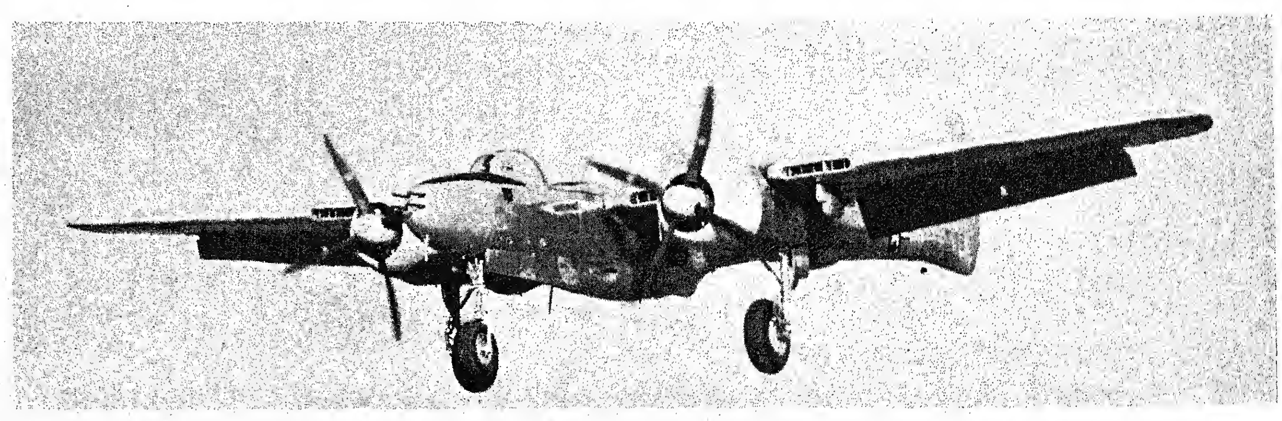
LANDING GEAR.—Retractable tricycle type. Each main unit consists of a Bendix wheel and brake assembly carried on inside of a single Bendix shock-absorber leg with side link member, which retracts backwards into engine nacelle. Nose-wheel carried in half-fork on Bendix shock-absorber leg which retracts backwards into nacelle. All wheels covered by mechanically-operated doors when retracted. Hydraulic operation.

POWER PLANT.—Two Pratt & Whitney R-2800-C Double Wasp eighteen-cylinder two-row radial air-cooled engines each developing a normal output of 2,100 h.p. and with 2,800 h.p. emergency power. Enclosed in long-chord tapered cowlings with trailing-edge controllable gills. Turbo-superchargers, with intake of 11,250 cub. ft. (318 cub. m.) per minute at 35,000 ft. (10,668 m.). Curtiss Electric four-blade full-feathering airscrews with A. O. Smith Co. "high activity" blades of increased chord. Diameter 12 ft. 8 in. (3.86 m.). Tip clearance 9 in. (22.86 cm.). Main fuel tank of 500 U. S. gallons (1,886 litres) capacity in fuselage aft of co-pilot, and secondary tanks in wings. Provision for long-range drop-tanks under both inner and outer wings. Cooling intakes in leading-edge on both sides of engine nacelles.

ACCOMMODATION.—Crew of two, consisting of pilot and co-pilot/navigator seated in tandem in long enclosed cockpit in nacelle. Pilot situated forward with flat bullet-proof panel and deflector plate. Moulded free-blown Plexiglas cover slides backwards for access. Fore and aft armour-plating. Full dual controls, allowing either member to operate cameras.

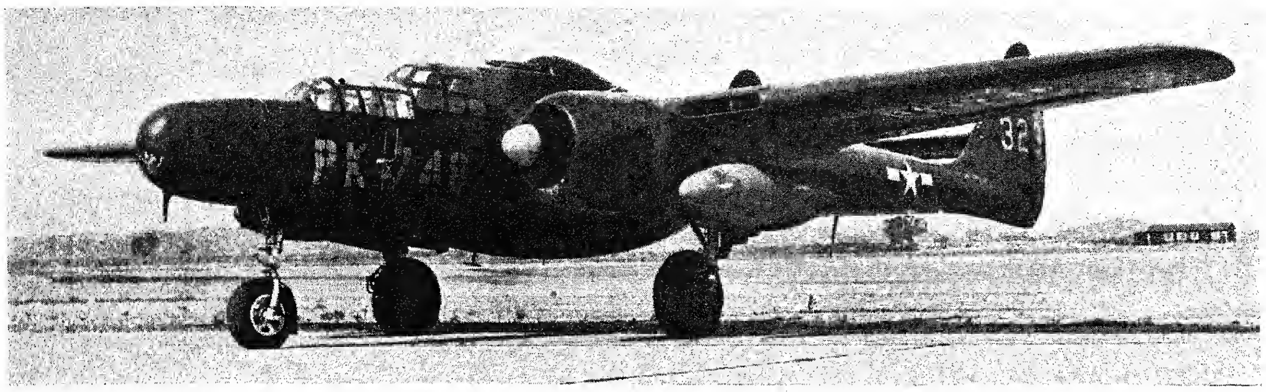
ARMAMENT.—None carried.

EQUIPMENT.—Provision for six forward shooting, vertical and oblique cameras of eleven different types and twenty-four alternative



The Northrop XP-61E with redesigned central nacelle which became the prototype for the XF-15 Reporter.

NORTHROP—*continued.*



The Northrop P-61B Black Widow Night Fighter (two 2,000 h.p. Pratt & Whitney R-2800-65 engines).—(*William T. Larkins*).

arrangements. Electrically-operated automatic pilot. Individual oxygen equipment.

DIMENSIONS.—Span 66 ft. 0 in. (20.12 m.), Length overall 50 ft. 3 in. (15.31 m.), Height to wing-tip 9 ft. 2 in. (2.79 m.).

WEIGHTS AND LOADINGS.—Weight loaded 28,000 lbs. (12,700 kg.), Wing loading 45.18 lbs./sq. ft. (220.59 kg./sq. m.). Power loading (at 2,100 h.p. per engine) 6.66 lbs./h.p. (3.02 kg./h.p.).

PERFORMANCE.—Maximum speed, over 440 m.p.h. (708 km.h.), Landing speed 80 m.p.h. (129 km.h.), Ceiling, over 35,000 ft. (10,668 m.), Maximum range with external tanks, over 4,000 miles (6,437 km.).

THE NORTHROP BLACK WIDOW.

U.S. Army Air Forces designation : P-61.
U.S. Navy designation : FT-1.

The Black Widow was built to an Army specification issued in 1940. Development began in 1940, an order for two XP-61s was placed in January, 1941, and the first prototype flew on May 26, 1942.

P-61A and P-61B. Generally similar, the earlier P-61A being fitted with two Pratt & Whitney R-2800-10 (B Series) and the later P-61A and P-61B with the R-2800-65 (C Series) engines, both with two-stage superchargers. Only the first 37 P-61As were fitted with the dorsal turret and carried crew of three. Provision for external auxiliary tanks on later P-61Bs.

P-61C. Two Pratt & Whitney R-2800-73 engines with single-stage superchargers and new Curtiss Electric airscrews with paddle-type blades. Aircraft fitted with slatted air-brakes on upper and lower surfaces of outer wings.

XP-61D. Similar to P-61A but fitted with two Pratt & Whitney R-2800-77 engines. One conversion only.

XP-61E. Long-range fighter version of P-61B. Later modified and redesignated XF-15 (which see).

XP-61F. Revised model of P-61C with two Pratt & Whitney R-2800-73 engines. One only.

TYPE.—Twin-engined Night Fighter.

WINGS, NACELLE AND TAIL BOOMS, TAIL UNIT AND LANDING GEAR.—Same as for F-15 Reporter.

POWER PLANT.—Two Pratt & Whitney R-2800-65 eighteen-cylinder radial air-cooled engines, each rated at 1,650 h.p. at 20,000 ft. (6,100 m.) and with 2,000 h.p. available for take-off. Curtiss Electric four-blade constant-speed full-feathering airscrews, 12 ft. 2 in. (3.7 m.) diameter. Water-injection. Self-sealing fuel tanks in wings. Streamline auxiliary drop tanks may be carried under wings outboard of engine nacelles in later P-61B *et seq.*

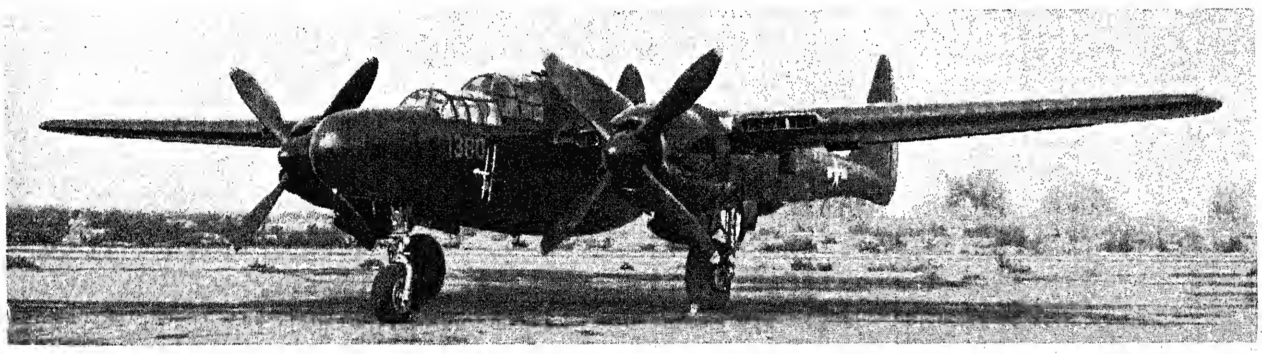
ACCOMMODATION.—Crew of three, comprising pilot, radar operator and turret gunner in central nacelle. All crew positions armoured.

ARMAMENT.—Four forward firing 20 m/m. cannon in underside of fuselage aft of nose-wheel well. First 37 P-61A, P-61B and P-61C have in addition, four 50 cal. machine-guns in a 360-degree electrically-operated General Electric dorsal turret. Turret remotely controlled and fired by the pilot or from either one of two gun-sighting stations, one forward and one aft. Full radar equipment.

DIMENSIONS.—Same as F-15 except length 48 ft. 11 in. (18.72 m.).

WEIGHT LOADED.—28,000 lbs. (12,712 kg.).

PERFORMANCE.—Maximum speed 375 m.p.h. (600 km.h.) at 17,000 ft. (5,190 m.), Landing speed 93 m.p.h. (149 km.h.), Climb to 25,000 ft. (4,575 m.) 13 min., Service ceiling 33,000 ft. (10,070 m.), Range 1,000 miles (1,600 km.) at 210 m.p.h. (336 km.h.) at 10,000 ft. (3,050 m.).



The Northrop P-16C Black Widow Night Fighter. Note the supercharger intakes beneath the engine nacelles.

PIASECKI

PIASECKI HELICOPTER CORPORATION.

HEAD OFFICE AND WORKS: SPRINGFIELD, DELAWARE COUNTY, PENNA.

President: Frank N. Piasecki.
Vice-President and Chief Engineer: Elliot Daland.
Vice-President and Works Manager: Harry S. Pack.
Secretary and Treasurer: Wesley R. Frysztacki.

This concern was organized in 1941 and incorporated in the State of Pennsylvania in 1943 as the P.V. Engineering Forum, Inc. The name was changed to the Piasecki Helicopter Corpn. in 1946.

It is engaged in the design, engineering and construction of rotary wing aircraft, specialising in helicopters. Its first helicopter—the PV-2—demonstrated for the first time in September, 1943, at the Washington National Airport, was the second American helicopter to be flown publicly.

The company is engaged in the development of several experimental helicopters for the U.S. services, including the XHRP-1 (PV-3) and XHJP-1 (PV-14) for the U.S. Navy, and the XR-16 (PV-15) for the U.S.A.A.F.

THE PIASECKI PV-2.

The PV-2 is an experimental single-seat single-rotor helicopter which first flew in the middle of 1943. The power plant is a 90 h.p. Franklin four-cylinder horizontally-opposed air-cooled engine vertically mounted aft of the pilot's compartment and driving through a universally-jointed shaft, the main three-blade rotor. The rotor blades have a constant chord of 9½ in. (24.1 cm.) except at root and tip, and are built round a steel-tube spar, with wood ribs, leading and trailing edges and fabric covering. The two-blade anti-torque, or directional, control rotor mounted aft on the right side of the fuselage is geared to maintain a constant speed relationship to the main rotor. With the main rotor turning at approximately 350 r.p.m.

PIASECKI—*continued.*

in normal horizontal cruising flight the anti-torque rotor turns at 1,600-1,700 r.p.m.

The column for fore-and-aft and lateral control is suspended from the roof of the cabin, with conventional foot pedals changing the pitch of the anti-torque rotor for directional control.

The rotor controls, of which no details are available, are housed in the fabric-covered faired disc some 3 ft. (.91 m.) in diameter which encloses the roots of the rotor blades. The PV-2 differs from other helicopters in that pitch can be set and the craft flown with the throttle. For take-off, the pitch control is set in the forward position and the throttle opened until the craft ascends vertically. To change from vertical to forward motion the control column is pushed forward and then eased back to neutral as the craft gains speed. The throttle can then be eased back to maintain cruising speed.

The fuselage is of normal welded steel-tube construction, faired up over the rotor mount to the rotor hub and covered with fabric. The landing gear is of the normal two-wheel and tail-skid type. The rotor blades may be grouped aft over the fuselage to allow the craft to be housed in an ordinary garage.

Dimensions.—Main rotor diameter 25 ft. 0 in. (7.62 m.), Anti-torque rotor diameter 5 ft. 0 in. (1.52 m.).

Weight Loaded.—1,000 lbs. (454 kg.).

Performance.—Maximum speed 90-100 m.p.h. (144-161 km.h.), Cruising speed 65 m.p.h. (104 km.h.).

THE PIASECKI PV-3.

U.S. Navy designation : XHRP-1.

The PV-3 is a large helicopter with accommodation for a crew of two and ten passengers. It has two large rotors, one at each end of the fuselage, which is 48 ft. (14.6 m.) long.

PIPER.

THE PIPER AIRCRAFT CORPORATION.

Head Office and Works : Lock Haven, Pennsylvania.

President, General Manager and Treasurer : W. T. Piper, Sr.

Vice-President : T. V. Weld.

Chief Engineer : Walter Jamouneau.

Secretary and Assistant Treasurer : W. T. Piper, Jr.

Originally the Taylor Aircraft Co., this firm was reorganized and renamed the Piper Aircraft Corpn. in 1937.

In 1938, the Company's first full year of production, 737 Cubs were built. The 1939 production totalled 1,806 and in 1940 3,016 Cubs were delivered. Production was further stepped up in 1941 and before the end of that year the 10,000th Cub had been completed.

During the War the Piper Company produced the L-4 Grasshopper light liaison and observation monoplane.

For post-war use the Company has evolved several new designs, including the single-seat Skycycle, the two-seat Skycoupe and the 165 h.p. four-seat Skysedan, while new models of the earlier Cubs are also available.

THE PIPER PA-6 SKYSEDAN.

Type.—Four-seat Cabin monoplane.

Wings.—Cantilever low-wing monoplane. Aerofoil section Modified U.S.A. 35B. All-metal structure of tapered plan form, with stressed metal skin. Detachable tips. Ailerons in outer sections, with split trailing-edge flaps between ailerons and fuselage.

Fuselage.—Steel-tube structure forward with metal covering. Aft section is monocoque structure with stressed metal skin.

Tail Unit.—Cantilever monoplane type with stressed metal skin on all surfaces. Tailplane span 11 ft. 11 in. (3.62 m.).

Landing Gear.—Retractable two-wheel type. Main wheels 7.00 × 6 carried on oleo-pneumatic shock-absorber struts retract inward into wing. Electric operation. Track 11 ft. 8 in. (3.55 m.). Non-retractable tail-wheel carried in half-fork. Goodyear tyres and Hayes wheels.

Power Plant.—One 165 h.p. Continental E-165 six-cylinder horizontally-opposed air-cooled engine driving Sensenich two-blade fixed-pitch airscrew. Fuel capacity 40 U.S. gallons (151 litres) in two wing tanks. Oil capacity 2.5 U.S. gallons (9.4 litres). Electric starter and generator.

Accommodation.—Enclosed cabin seating four in two pairs, with access doors at sides. Dual controls. Baggage compartment under seats ; allowance 100 lbs. (54 kg.).

Dimensions.—Span 34 ft. 8 in. (10.56 m.), Length 26 ft. 0 in. (7.93 m.), Height 7 ft. 0 in. (2.13 m.).

Weights.—Weight empty 1,360 lbs. (617 kg.), Useful load 1,040 lbs. (472 kg.), Weight loaded 2,400 lbs. (1,089 kg.).

Performance (Estimated).—Maximum speed 160 m.p.h. (257 km.h.), Cruising speeds 150 m.p.h. (241 km.h.) at 125 h.p. at sea level, and 140 m.p.h. (225 km.h.) at 100 h.p. at sea level, Economic cruising speed 120 m.p.h. (193 km.h.) at 40% power, Landing speed (with flaps) 49 m.p.h. (79 km.h.) ; (without flaps) 55 m.p.h. (88 km.h.), Cruising range 620 miles (998 km.) at 140 m.p.h. (225 km.h.). Fuel consumption 40 U.S. gallons/hr. (151 litres/hr.).

THE PIPER SKYCYCLE.

The Skycycle is an experimental single-seat low-wing monoplane with a fixed cantilever two-wheel landing-gear. The forward portion of the fuselage of the prototype is composed of a plastic drop-tank from a Lockheed P-38 Lightning, the cantilever monoplane tail-unit being carried on a single boom extending therefrom. The power-unit consists of a 40 h.p. Continental four-cylinder horizontally-opposed air-cooled engine driving a two-blade wooden airscrew.

The Skycycle has a speed of about 115 m.p.h. (185 km.h.), and a range of approximately 400 miles (644 km.). The loaded weight is 630 lb. (286 kg.).

It is intended to sell the Skycycle at under $1,000, and the design has been temporarily shelved until cheaper materials are available.

Dimensions.—Span 20 ft. 0 in. (6.10 m.), Length 15 ft. 8 in. (4.77 m.), Height 5 ft. 0 in. (1.52 m.).

THE PIPER SKYCOUPE.

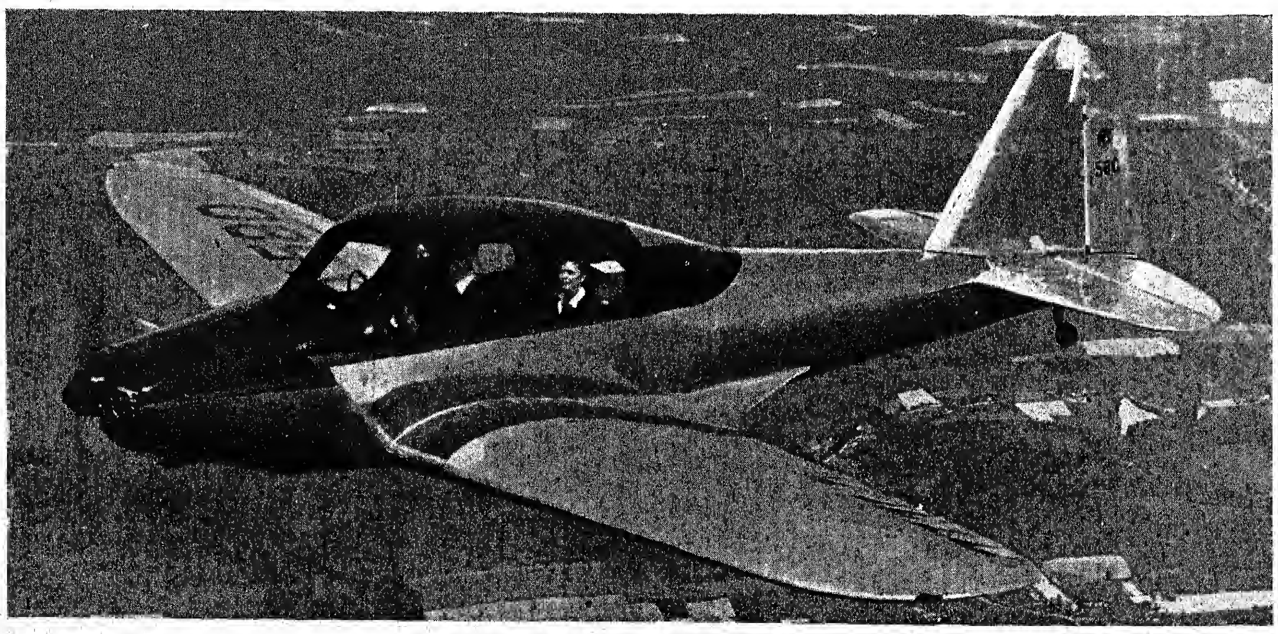
The Skycoupe is an experimental two-seat enclosed low-wing pusher monoplane with twin booms and a tricycle landing-gear. It is powered by a 113 h.p. Franklin 4ACG-199-H3 four-cylinder horizontally-opposed air-cooled engine driving a two-blade propeller. It has a span of 30 ft. 0 in. (9.14 m.) ; and a loaded weight of 1,597 lb. (724 kg.). The maximum speed is about 110 m.p.h. (177 km.h.). No further details are available.

THE PIPER PT-1 TRAINER.

Type.—Two-seat enclosed Training monoplane.

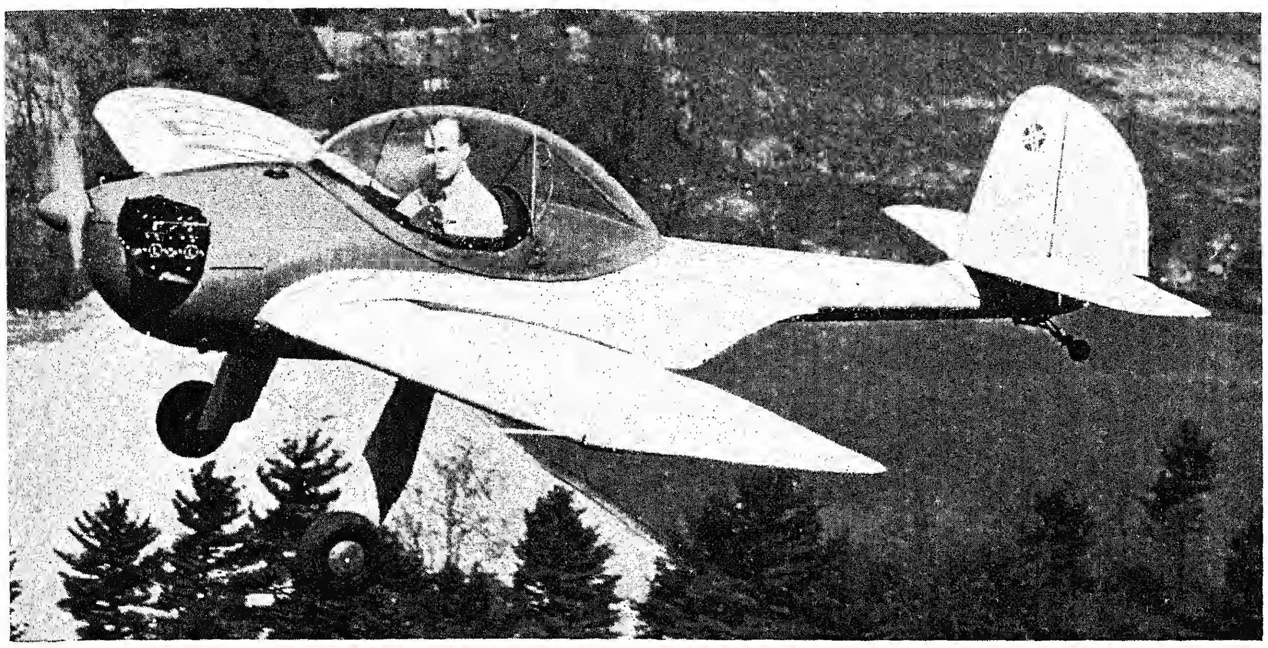
Wings.—Wooden cantilever low-wing monoplane with single built-up box spar, wooden ribs, and stressed plywood skin, over which is fabric covering. Ailerons in outer sections. NACA slotted flaps.

Fuselage.—Warren-truss structure with four steel-tube longerons and plywood turtle deck, the whole covered with fabric.



The Piper PA-6 Skysedan Four-seat Cabin Monoplane (165 h.p. Continental E165 engine).

***PIPER**—continued.*



The experimental Piper Skycycle Single-seat Monoplane, the fuselage of which is formed by a plastic drop-tank.

Tail Unit.—Wooden monoplane structure, with plywood covering. External wire-bracing. Horn-balanced rudder and elevators.

Landing Gear.—Retractable two-wheel type, mechanically-operated. Hydraulic brakes. Non-retractable tail-wheel.

Power Plant.—One 130 h.p. Franklin 6AC-298 six-cylinder horizontally-opposed air-cooled engine driving two-blade fixed-pitch or variable-pitch airscrew.

Accommodation.—Crew of two in tandem in continuous enclosed cockpit, with hinged panels for access. Steel-tube crash-pylon between seats.

Dimensions.—Span 35 ft. 2½ in. (10.72 m.), Length 22 ft. 10 in. (6.96 m.), Height 6 ft. 6 in. (1.98 m.).

Weights.—Weight empty 1,325 lbs. (601 kg.), Pay-load 675 lbs. (306 kg.).

Performance.—Maximum level speed, over 150 m.p.h. (241 km.h.), Cruising speed, over 135 m.p.h. (217 km.h.), Landing speed, under 50 m.p.h. (80 km.h.), Climb 750-1,000 ft./min. (229-305 m./min.), according to airscrew, Service ceiling 12,400 ft. (3,780 m.), Range 700 miles (1,126 km.).

THE PIPER J3C-65 CUB SPECIAL.

Type.—Two-seat Light Cabin monoplane.

Wings.—Structure as L-14. No flaps. Gross wing area 178.5 sq. ft. (16.58 sq. m.); aileron area (total) 19.2 sq. ft. (1.78 sq. m.).

Fuselage.—Structure as L-14.

Tail Unit.—Structure as L-14. Tailplane span 9 ft. 6 in. (2.89 m.). Fin area 4.0 sq. ft. (.37 sq. m.); rudder area 6.5 sq. ft. (.60 sq. m.); tailplane area 14.7 sq. ft. (1.36 sq. m.); elevator area (total) 11.6 sq. ft. (1.67 sq. m.).

Landing Gear.—Fixed divided type. Two side vees and half axles hinged to *cabane* below fuselage. Rubber cord shock-absorption. Hayes wheels 841 (8.00 × 4 tyres). Hydraulic expander tube brakes. Track 5 ft. 11 in. (1.80 m.). Leaf-spring steerable tail-wheel. Alternatively twin-float or ski undercarriage.

Power Plant.—One Continental A65-8 four-cylinder horizontally-opposed air-cooled engine developing 65 h.p. at 2,300 r.p.m. and driving Sensenich two-blade fixed-pitch wooden airscrew, 6 ft. 0 in. (1.829 m.) diameter. Fuel capacity 12 U.S. gallons (45 litres); oil capacity 1 U.S. gallon (3.7 litres).

Accommodation.—Enclosed cabin seating two in tandem with dual controls, either set being removable. One-piece Plexiglas windscreen. Baggage compartment 10 in. × 11 in. × 24 in. (25.4 × 28 × 61 cm.) aft of rear seat. Baggage allowance 20 lbs. (9 kg.).

Dimensions.—Span 35 ft. 2½ in. (10.72 m.), Length 22 ft. 4½ in. (6.82 m.), Height 6 ft. 8 in. (2.03 m.).

Weights and Loadings.—Weight empty 680 lbs. (308 kg.), Useful load 540 lbs. (245 kg.), Weight loaded 1,220 lbs. (553 kg.), Wing loading (fully loaded) 6.8 lbs./sq. ft. (33.2 kg./sq. m.), Power loading (fully loaded) 18.76 lbs./h.p. (8.48 kg./h.p.). C.G. limits 10.6-22.7 in. (26.9-57.6 cm.).

Performance.—Maximum speed (fully loaded, no wind) 83 m.p.h. (133 km.h.) at sea level, Cruising speed 73 m.p.h. (117 km.h.), Landing speed 39 m.p.h. (63 km.h.), Climb 450 ft./min. (137 m./min.), Absolute ceiling 14,000 ft. (4,265 m.), Cruising range 200 miles (322 km.), Take-off run 370 ft. (113 m.), Landing run 290 ft. (88 m.), Gliding ratio 10 : 1, Fuel consumption 4.4 U.S. gallons p.h. (17 litres p.h.).

THE PIPER J4 CUB COUPÉ.

Type.—Two-seat light cabin monoplane.

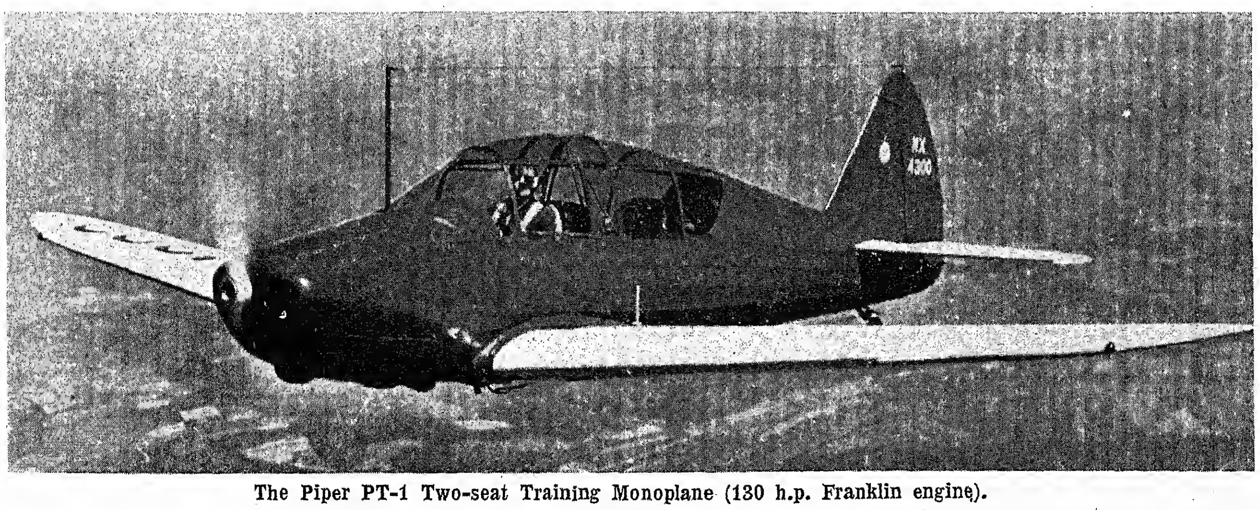
Wings.—Strut-braced high-wing monoplane. Two-spar structure in two sections attached to fuselage and braced to lower longerons by steel-tube V-struts. Spruce spars and aluminium-alloy ribs, with fabric covering. Gross wing area 183 sq. ft. (17.01 sq. m.). Metal-framed Frise-type ailerons with fabric covering.

Fuselage.—Rectangular steel-tube structure with fabric covering.

Tail Unit.—Braced monoplane type. Welded steel-tube framework covered with fabric. Self-aligning streamline wire bracing. Elevator tab adjustable in flight.

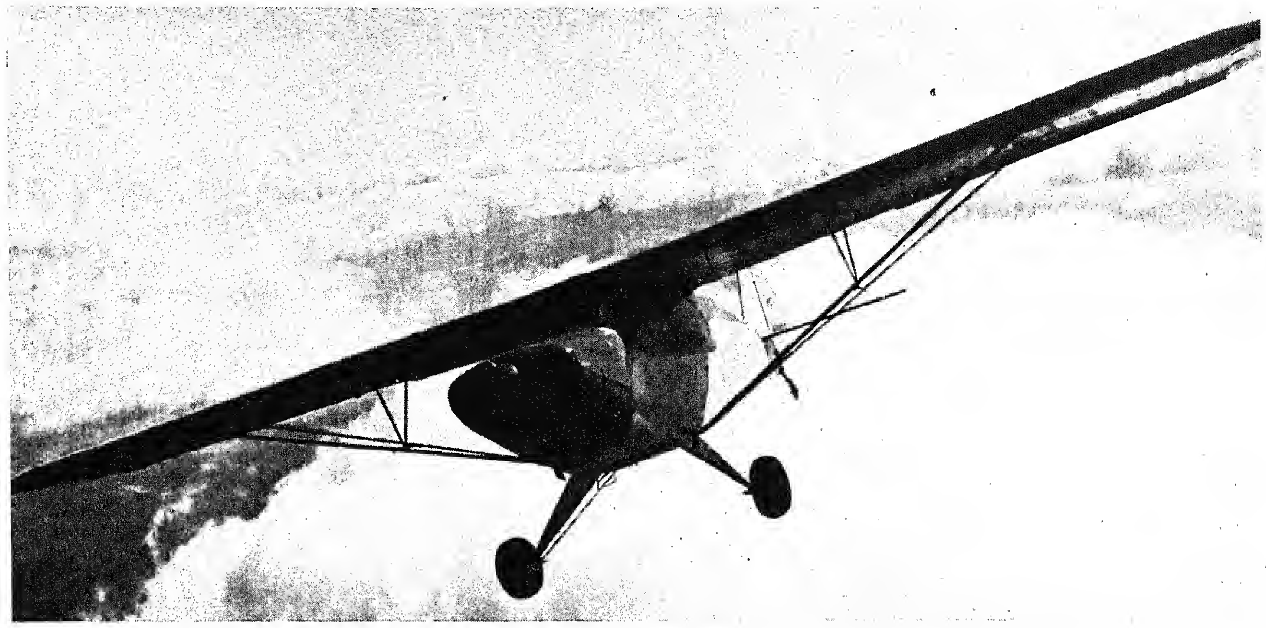
Landing Gear.—Divided type. Faired-in side Vees incorporate oleo-springing. Hayes wheels and hydraulic brakes. Wheels enclosed in streamline fairings. Full-swivelling tail-wheel. Wheel landing gear may be replaced by twin metal floats.

Power Plant.—One 75 h.p. Continental A-75-8 four-cylinder horizontally-opposed air-cooled engine on welded steel-tube mounting. Engine completely enclosed in hinged cowling. Fuel tank of 16 U.S. gallons (60 litres) capacity in fuselage.



The Piper PT-1 Two-seat Training Monoplane (130 h.p. Franklin engine).

PIPER—continued.



The Piper J5C-104 Super-Cruiser Three-seat Cabin Monoplane (104 h.p. Lycoming engine).

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Doors on each side of cabin. Luggage compartment aft of cabin. Cabin heater.

DIMENSIONS.—Span 36 ft. 2 in. (11.5 m.), Length 22 ft. 6 in. (6.9 m.), Height 6 ft. 10 in. (2.1 m.).

WEIGHTS AND LOADINGS.—Weight empty 865 lbs. (392 kg.), Pay load 275 lbs. (125 kg.), Disposable load 535 lbs. (242 kg.), Weight loaded 1,400 lbs. (637 kg.), Wing loading 7.64 lbs./sq. ft. (37.3 kg./sq. m.), Power loading 18.7 lbs./h.p. (8.5 kg./h.p.).

PERFORMANCE.—Maximum speed 100 m.p.h. (161 km.h.), Cruising speed 96 m.p.h. (150 km.h.), Landing speed 40 m.p.h. (64 km.h.), Initial rate of climb 450 ft./min. (138 m./min.), Service ceiling 12,000 ft. (3,660 m.), Cruising range 455 miles (735 km.).

THE PIPER J5C-104 SUPER-CRUISER.

TYPE.—Three-seat Light Cabin monoplane.

WINGS.—Structure as L-14. No flaps. Chord 5 ft. 3 in. (1.6 m.); gross wing area 179.3 sq. ft. (16.65 sq. m.); aileron area (total) 19.2 sq. ft. (1.78 sq. m.).

FUSELAGE.—Structure as L-14.

TAIL UNIT.—Structure as L-14. Fin area 4.7 sq. ft. (.43 sq. m.); rudder area 6.8 sq. ft. (63 sq. m.); tailplane area 15.10 sq. ft (1.4 sq. m.); elevator area (total) 11.7 sq. ft. (1.08 sq. m.).

LANDING GEAR.—Fixed divided type. Two side vees and half-axles hinged to *cabane* within fuselage. Rubber cord shock-absorption. Hayes wheels 841 (8.00 × 4 tyres). Hydraulic expander tube brakes. Track 6 ft. 2½ in. (1.89 m.). Three leaf-spring full-swivelling tailwheel. Alternatively twin-float or ski undercarriage.

POWER PLANT.—One Lycoming 0-235-C four-cylinder horizontally-opposed air-cooled engine enclosed in hinged pressure cowling, and developing 104 h.p. at 2,600 r.p.m. Sensenich two-blade fixed-pitch wooden airscrew, 6 ft. 2 in. (1.88 m.) diameter. Fuel capacity 38 U.S. gallons (143 litres); oil capacity 2 U.S. gallons (7.5 litres).

ACCOMMODATION.—Enclosed cabin seating pilot forward and two passengers side-by-side in rear seat. Dual controls, rear set removable. Access door on starboard. Baggage compartment 13 × 12 × 30 in. (33 × 30.5 × 76 cm.) aft of rear seat. Baggage allowance 41 lbs. (18.6 kg.).

DIMENSIONS.—Span 35 ft. 5¼ in. (10.80 m.), Length 22 ft. 6 in. (6.85 m.), Height 6 ft. 10 in. (2.08 m.).

WEIGHTS AND LOADINGS.—Weight empty 1,000 lbs. (454 kg.), Useful load 750 lbs. (340 kg.), Weight loaded 1,750 lbs. (793 kg.), Wing loading (fully loaded) 9.76 lbs./sq. ft. (47.65 kg./sq. m.), Power loading 16.82 lbs./h.p. (7.63 kg./h.p.). C.G. limits 9-18.6 in. (22.86-47.2 cm.).

PERFORMANCE.—Maximum speed (fully loaded, no wind) 115 m.p.h. (185 km.h.) at sea level, Cruising speed 103 m.p.h. (166 km.h.), Landing speed 48 m.p.h. (77 km.h.), Climb 510 ft./min. (155 m./min.), Absolute ceiling 15,500 ft. (4,725 m.), Absolute ceiling at 1,550 lbs. (703 kg.) 17,800 ft. (5,425 m.), Cruising range 600 miles (965 km.), Take-off run 640 ft. (195 m.), Take-off run at 1,550 lbs. (703 kg.) 480 ft. (146 m.), Landing run 410 ft. (125 m.), Landing run at 1,550 lbs. (703 kg.) 360 ft. (110 m.), Gliding ratio 11 : 1, Fuel consumption 6.5 U.S. gallons p.h. (41 litres p.h.).

PLATT-LE PAGE.

PLATT-LE PAGE AIRCRAFT COMPANY.

HEAD OFFICE AND WORKS: EDDYSTONE, PENNSYLVANIA.
President: W. Laurence Le Page.
Vice-President: Haviland H. Platt.
Vice-President and Treasurer: J. Brooks B. Parker.
Secretary: H. F. A. Sessions.

This company is devoting its attention to rotary wing aircraft. During the war its entire resources were devoted to confidential work for the U.S. Government, including the development and production of experimental rotary wing aircraft for the Army Air Forces, of which the XR-1 and XR-1A experimental helicopters may be mentioned.

The company has under development the PL-11 mail-carrying helicopter and the PL-14, an eight-seat amphibious helicopter which was scheduled for completion at the end of 1946. The only details available on these two types are given hereafter.

THE PLATT-LE PAGE PL-11.

The PL-11 is a commercial modification of the XR-1A experimental single-engined helicopter, brief particulars of which were given in the last issue of "All the World's Aircraft." The PL-11 is intended for short-range mail-carrying duties and differs from the military aircraft only in detail.

The PL-11 has two three-blade oppositely-rotating rotors 30 ft. 6 in. (9.29 m.) in diameter, which are carried on faired extensions projecting one from each side of the fuselage. The power-plant is a 450 h.p. Pratt & Whitney R-985 Wasp-Junior nine-cylinder radial engine which is pressure-cooled and mounted within the fuselage. The rotors are driven through a geared transmission.

The tail-unit is for stability and trimming purposes only and consists of a strut-braced tailplane mounted half-way up the vertical fin. The landing-gear is of the fixed divided type, each main wheel being full-swivelling and carried on a faired high-travel shock-absorber leg attached to the rotor extensions. The enclosed cabin in the nose seats two side-by-side with dual controls, or one with freight space. The useful load is 1,200 lbs. (544 kg.) and the payload 700 lbs. (317 kg.).

PERFORMANCE (Estimated).—Maximum speed 115 m.p.h. (185 km.h.), Cruising speed 95 m.p.h. (153 km.h.), Rate of climb with full load 1,500 ft./min. (457 m./min.), Sinking speed with power off 1,200 ft./min. (366 m./min.), ceiling 15,000 ft. (4,570 m.), Range 400 miles (644 km.), Maximum endurance at 50 m.p.h. (80 km.h.) 7 hours.

THE PLATT-LE PAGE PL-12.

The PL-12 is identical to the PL-11 but has modified cabin arrangements with accommodation for four persons.

THE PLATT-LE PAGE PL-14.

The PL-14 is a twin-engined twin-rotor commercial amphibian helicopter of typical Platt-Le Page lay-out. It will have accommodation for a crew of two and six passengers. The passenger seats will be removable for the carriage of freight. In addition it will also be available as an ambulance with accommodation for four stretcher cases and medical attendants. The useful load will be 2,000 lbs. (907 kg.) and the payload 1,125 lbs. (510 kg.).

The PL-14 will be powered by two 300 h.p. engines mounted in the fuselage, the rotors being driven through a geared transmission with an overriding connection for single-engine operation.

The wheel landing-gear will be retractable.

PERFORMANCE (Estimated).—Maximum speed 120 m.p.h. (193 km.h.), Cruising speed 100 m.p.h. (161 km.h.), Rate of climb with full load 1,200 ft./min. (366 m./min.), Sinking speed with power off 1,200 ft./min. (366 m./min.), Ceiling 15,000 ft. (4,570 m.), Range 400 miles (644 km.), Endurance at 70 m.p.h. (113 km.h.) 5 hours, level flight maintained on one engine at 70 m.p.h. (113 km.h.) at gross weight, approximately 2,000 ft. (610 m.).

PUGET PACIFIC.

PUGET PACIFIC PLANES, INC.

Head Office and Works: 1922, Pacific Avenue, Tacoma, Wash.

President: James A. Edman.

Vice-President: William C. Chafin.

Chief Engineer: Donald T. Wheeler.

Secretary and Treasurer: Roland G. Enos.

This company has been formed to build and market the Wheelair four-seat all-metal monoplane with pusher airscrew, a design with which Donald Wheeler won a prize in a design contest conducted by a national magazine.

A licence for the manufacture of the Wheelair in Europe has been negotiated with a French concern.

THE PUGET PACIFIC WHEELAIR IIIA.

Type.—Four-seat twin-boom Pusher monoplane.

Wings.—Cantilever low-wing monoplane, consisting of centre-section carrying nacelle and twin booms and two outer sections. Metal spars and ribs and sheet metal covering. All-metal ailerons and hydraulically-operated trailing-edge flaps. Wing area 179.2 sq. ft. (16.63 sq. m.).

Nacelle and Tail Booms.—All-metal semi-monocoque structures; tail-booms extend aft from wing to carry tail-unit.

Tail Unit.—All-metal cantilever structure consisting of tailplane and one-piece elevator between booms, and twin fins and rudders.

Landing Gear.—Fixed tricycle type. Each main wheel (Goodyear 7.00 × 6) carried on oleo shock-absorber leg, and steerable nose-wheel carried in fork. Track 9 ft. 11 in. (3.02 m.). Goodyear hydraulic brakes, tyres and wheels.

Power Plant.—One Lycoming O-435-AP six-cylinder horizontally-opposed air-cooled engine developing 190 h.p. at 2,550 r.p.m. mounted as pusher unit at rear of nacelle and driving Sensenich two-blade fixed-pitch wooden propeller. Fuel capacity 50 U.S. gallons (189 litres).

Accommodation.—Enclosed cabin seating four in two pairs on full-width seats. Throw-over dual controls. Access door on each side. Baggage compartment of 24 cub. ft. (0.67 cub. m.) capacity aft of cabin; allowance 160 lbs. (72.5 kg.).

Dimensions.—Span 37 ft. (11.28 m.), Length 26 ft. 6½ in. (8.10 m.), Height 7 ft. 0½ in. (2.15 m.).

Weights and Loadings (Designed).—Weight empty 1,350 lbs. (612 kg.), Disposable load 1,150 lbs. (522 kg.), Weight loaded 2,500 lbs. (1,134 kg.), Wing loading 13.95 lbs./sq. ft. (68 kg./sq. m.), Power loading 13.10 lbs./h.p. (5.93 kg./h.p.).

Performance (Estimated).—Maximum speed 140 m.p.h. (225 km.h.), Cruising speed 125 m.p.h. (201 km.h.), Landing speed 55 m.p.h. (88.5 km.h.), Initial rate of climb 760 ft./min. (232 m./min.), Service ceiling 11,500 ft. (3,505 m.), Cruising range 600 miles (966 km.), Take-off run 253 yds. (231 m.), Landing run 150 yds. (137 m.), Fuel consumption 9.5 U.S. gallons/hr. (36 litres/hr.).

REPUBLIC.

THE REPUBLIC AVIATION CORPORATION.

Head Office and Works: Farmingdale, Long Island, N.Y.

President: Munday I. Peela.

Vice-President and General Manager: C. Hart Miller.

Vice-President in Charge of Engineering: Alexander Kartveli.

Vice-President (Special Assignments): Harrison W. Flickinger.

Vice-President and Counsel: John J. Ryan.

Secretary and Treasurer: Thomas Davis.

When the war ended the Republic Aviation Corpn. was in large-scale production with the P-47 Thunderbolt. After VJ-Day military production was drastically cut-back and the Thunderbolt was finally withdrawn from production in December, 1945, after 15,329 had been built. Two advanced types of military aircraft were under development at that time, the XF-12 high-altitude long-range photographic-reconnaissance monoplane, the prototype of which flew on February 7, 1946, and the XP-84 jet-propelled fighter which first flew on February 28, 1946. Production orders for over 500 P-84A fighters has since been placed with the company. Republic is also engaged in several classes of experimental and development work for the U.S. Army Air Forces.

For the transition from war to peacetime production, the Company undertook the conversion of a number of Douglas C-54 Army transports into commercial airliners for American Airlines while preparations were made for the production of the Seabee four-seat amphibian, and the design of the XF-12 was adopted for commercial use as the RC-2 Rainbow, a high performance airliner to carry 46 passengers and to cruise at 400 m.p.h. (644 km.h.) at 30,000 ft. (9,145 m.).

In December, 1945, the Republic Aviation Corpn. bought the Aircooled Motors Corpn., taking over its entire assets, including orders for Franklin engines totalling in value nearly six million dollars. This transaction ensured the Company of an adequate supply of engines for the Republic Seabee.

THE REPUBLIC RC-3 SEABEE.

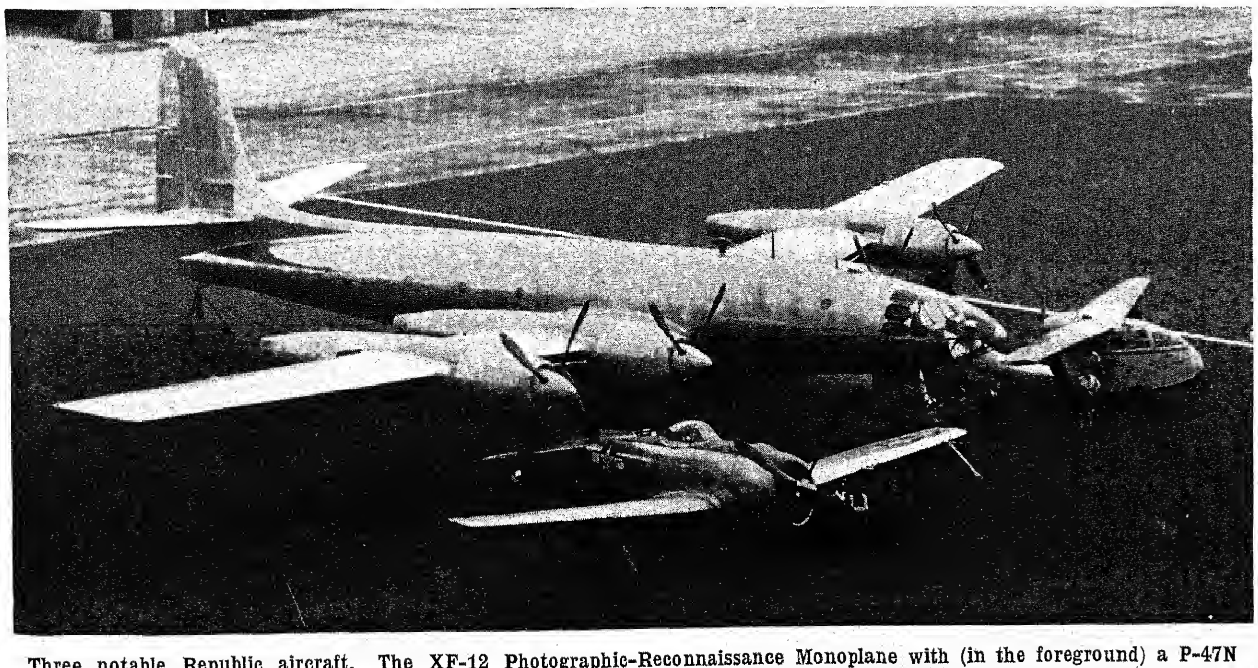
The RC-3 Seabee is the production model of the three-seat RC-1 described in the last issue of "All the World's Aircraft." The RC-1 prototype which appeared in November, 1944, was of orthodox construction and was powered by a 175 h.p Franklin 6ALG-365 engine. The RC-3 has a re-designed constant-chord wing comprising a minimum of components, and as a result the wing structure weighs only 110 lbs. (50 kg.) instead of 150 lbs. (68 kg.). The number of parts in the wing has been reduced from 114 to 30. The structure weight of the hull has been reduced to 298 lbs. (135 kg.) from 318 lbs. (144 kg.), and the re-design of the complete aircraft represents a decrease in production man-hours from 2,500 to 200 per aircraft.

The RC-3 was granted an Approved Type Certificate on July 1, 1946, and the Seabee is now in production.

Type.—Four-seat Amphibian Flying-boat.

Wings.—Semi-cantilever high-wing monoplane braced to hull by single strut on each side. All-metal constant-chord structure with three spars and three chordal ribs forming torsion box, and pre-formed corrugated metal skin applied in two sections and riveted on. Top and bottom skins welded at trailing-edge. Detachable tips. All-metal slotted ailerons and hydraulically-operated trailing-edge flaps are interchangeable left and right. Aspect ratio 7.23. Gross wing area 196 sq. ft. (18.2 sq. m.).

Hull.—Shallow two-step hull with cabin structure forward and rear portion swept upwards to carry tail-unit. All-metal structure with Alclad covering. Draught 1 ft. 6 in. (0.51 m.). All-metal monocoque stabilizing wing-tip floats consisting of two pressings riveted along outward-turned flanges and attached by single cantilever struts.



Three notable Republic aircraft. The XF-12 Photographic-Reconnaissance Monoplane with (in the foreground) a P-47N Thunderbolt Fighter and an RC-3 Seabee Light Four-seat Amphibian.

REPUBLIC—*continued.*

The Republic RC-3 Seabee Light Four-seat Amphibian Flying-boat (215 h.p. Franklin engine).

Tail Unit.—Cantilever monoplane type. All-metal structure similar to wings, with corrugated metal covering over all surfaces. Adjustable trim-tab on rudder; controllable trim-tab in each elevator.

Landing Gear.—Retractable type. Main wheels, carried on Electrol Model 400-2 cantilever gear, swing backward alongside hull. Hydraulic operation. Track 8 ft. (2.44 m.), wheel base 12 ft. 10 in. (3.91 m.). Non-retractable full-swivelling tail-wheel at rear step, with corrugated metal water-rudder aft.

Power Plant.—One Franklin 6A8-215-B8F six-cylinder horizontally-opposed air-cooled engine rated at 215 h.p. at 2,500 ft. (760 m.) mounted as pusher unit above cabin and driving an Aeromaster two-blade adjustable-pitch wooden propeller, 7 ft. 0 in. (2.13 m.) diameter. Hartzell two-blade reversible-pitch wooden propeller optional at extra cost. Rubber-impregnated fabric-bag fuel tank in hull in watertight compartment between bulkheads just forward of main step with capacity of 75 U.S. gallons (284 litres) 80-octane fuel. Oil capacity 3 U.S. gallons (11 litres).

Accommodation.—Enclosed cabin seating four in two pairs. Dual controls with swing-over control wheel. Cabin measures 9 ft. 2 in. long × 3 ft. 10 in. wide × 4 ft. 2 in. high (2.79 m. × 1.17 m. × 1.27 m.). Lucite windshield and side-windows. Access door on each side. Door in nose for mooring, etc. Baggage compartment of 20 cub. ft. (0.56 cub. m.) capacity aft of rear seats.

Equipment.—Hallicrafters Skyfone CA-4 two-way radio.

Dimensions.—Span 37 ft. 8 in. (11.47 m.), Length 27 ft. 11 in. (8.5 m.), Height (on wheels, tail down) 9 ft. 7 in. (2.91 m.).

Weights and Loadings.—Weight empty, 1,950 lbs. (884 kg.), Useful load 1,050 lbs. (476 kg.), Baggage allowance with pilot, one passenger and 75 U.S. gallons (284 litres) fuel 240 lbs. (109 kg.), Baggage allowance with pilot, three passengers and 45 U.S. gallons (171 litres) fuel 80 lbs. (36 kg.), Weight loaded 3,000 lbs. (1,361 kg.), Wing loading 15.3 lbs./sq. ft. (74.7 kg./sq. m.), Power loading 14.2 lbs./h.p. (6.43 kg./h.p.).

Performance.—Maximum speed 120 m.p.h. (193 km.h.), Cruising speed (75% power) 103 m.p.h. (166 km.h.), Landing speed 58 m.p.h. (93 km.h.), Initial rate of climb 700 ft./min. (213 m./min.), Service ceiling 12,000 ft. (3,660 m.), Cruising range 560 miles (901 km.), Take-off run (fully loaded) 267 yds. (244 m.), Take-off run from water (fully loaded) 333 yds. (305 m.), Take-off time (water) 25 seconds, Landing run 133 yds. (122 m.), Alighting run (water 233 yds. (213 m.).

THE REPUBLIC XF-12.

The XF-12 is the first four-engined aircraft to be built for the U.S.A.A.F. specifically for photographic-reconnaissance duties, and was intended for operation in the Pacific theatre. The specification drawn up by the A.A.F. Office of Commitments and Requirements was first published by the Air Technical Service Command in October, 1943. Republic's proposed design was submitted to the Army in the following December and instructions to proceed were granted in January, 1944. Plans were revised in June after inspection of the mock-up and a new mock-up was approved in November, 1944. Construction was undertaken in secret, and the prototype XF-12 made its first flight on February 7, 1946, over Long Island.

The XF-12 also serves as the prototype of the RC-2 Rainbow airliner.

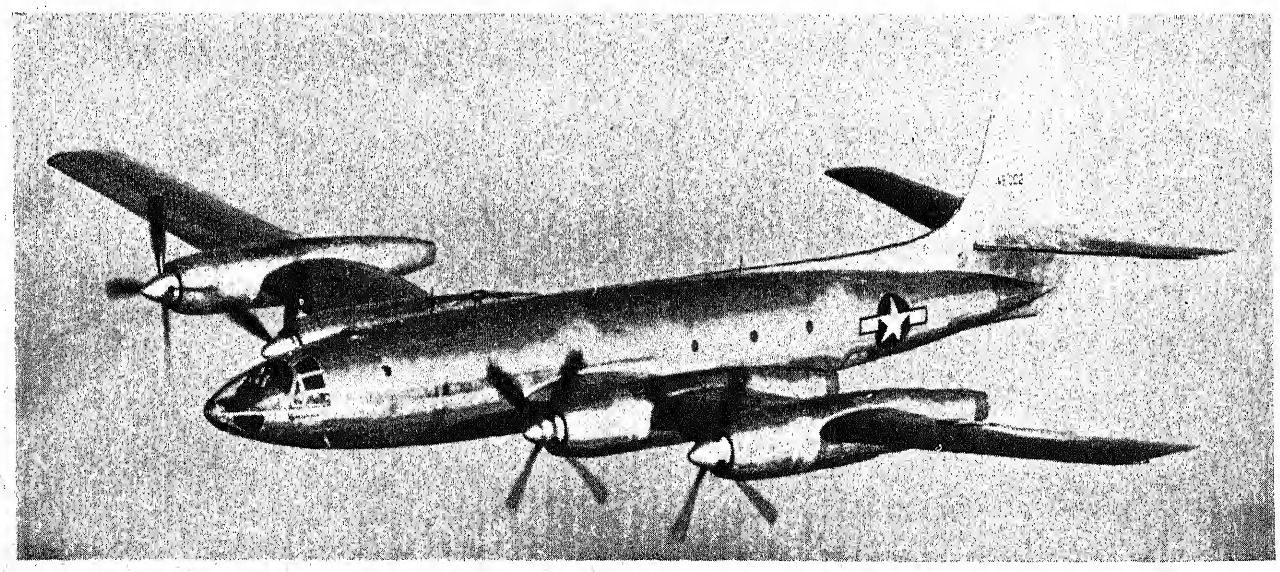
Type.—Long-range Photographic-Reconnaissance monoplane.

Wings.—Cantilever mid-wing monoplane. Metal construction, with stressed metal skin. All-metal ailerons, with Fowler-type trailing-edge flaps between ailerons and fuselage divided by nacelles. Trim and balance-tabs in each aileron. Gross wing area 1,640 sq. ft. (152.3 sq. m.).

Fuselage.—All-metal monocoque structure of circular cross-section. Maximum external diameter 10 ft. 3 in. (3.12 m.).

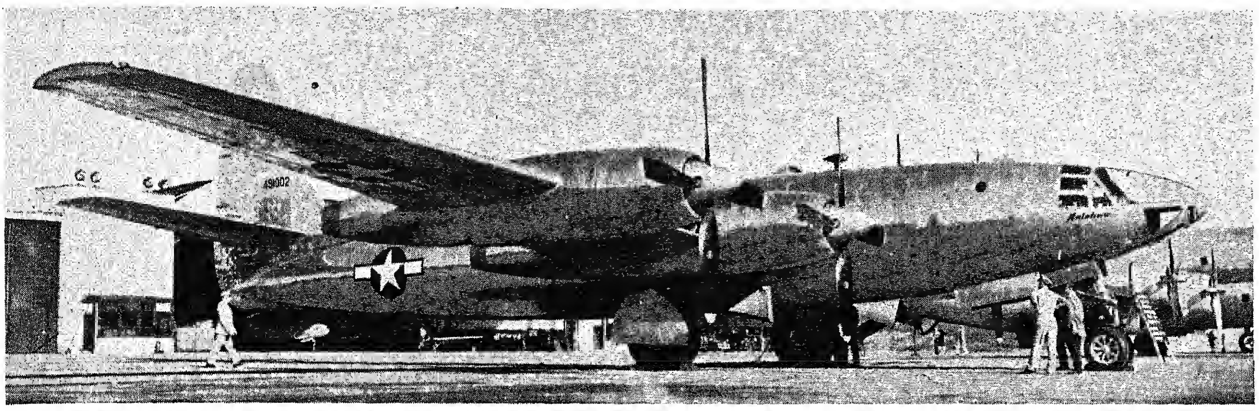
Tail Unit.—Cantilever monoplane type. Metal structure with dihedral tailplane. Balanced rudder and elevators with metal covering, and trim and balance-tabs in each. Tailplane span 44 ft. 0 in. (13.41 m.).

Landing Gear.—Retractable tricycle type. Main wheels retract inwards into wing between fuselage and inner nacelles, and nose-unit mounting twin wheels retracts backwards into fuselage. Faired bump-skid under tail. Wheel track 24 ft. 3 in. (7.39 m.), wheel base 30 ft. 9 in. (9.37 m.).



The Republic XF-12 Photographic-Reconnaissance Monoplane the prototype of the RC-2 Rainbow Airliner.

REPUBLIC—*continued.*



The Prototype Republic XF-12 Photographic-Reconnaissance Monoplane (four 3,000 h.p. Pratt & Whitney Wasp-Major engines).—(*Peter M. Bowers*).

Power Plant.—Four 3,000 h.p. Pratt & Whitney R-4360 Wasp-Major twenty-eight-cylinder four-row radial air-cooled engines in circular-section nacelles extending aft of trailing-edge. Two General Electric exhaust-driven turbines in rear of each nacelle obtaining a jet thrust of approximately 200 h.p. per engine. Two-speed cooling fans. Air intakes in leading-edge of wing between inner and outer engine nacelles. Curtiss four-blade reversible-pitch airscrews, 16 ft. 2 in. (4.9 m.) diameter. Fuel capacity 5,000 U.S. gallons (18,926 litres).

Accommodation.—Crew of seven in fully-pressurized cabin of 3,700 cub. ft. (104.7 cub. m.) capacity.

Equipment.—Full radio and radar equipment, with three camera installations comprising one split vertical, one trimetrogen and one vertical camera. Dark-room for loading film. 18 photo-flash bombs for night photography carried in bomb-bay.

Dimensions.—Span 129 ft. 2 in. (39.36 m.), Length 93 ft. 10 in. (28.59 m.), Height (over fin) 28 ft. 4 in. (8.63 m.).

Weights and Loadings.—Weight loaded 101,400 lbs. (45,994 kg.), Wing loading (at loaded weight) 61.8 lbs./sq. ft. (301.7 kg./sq. m.), Power loading 8.4 lbs./h.p. (3.8 kg./h.p.).

Performance (Estimated).—Maximum speed, over 450 m.p.h. (724 km.h.), Service ceiling, over 44,000 ft. (13,410 m.), Range 4,500 miles (7,242 km.).

THE REPUBLIC RC-2 RAINBOW.

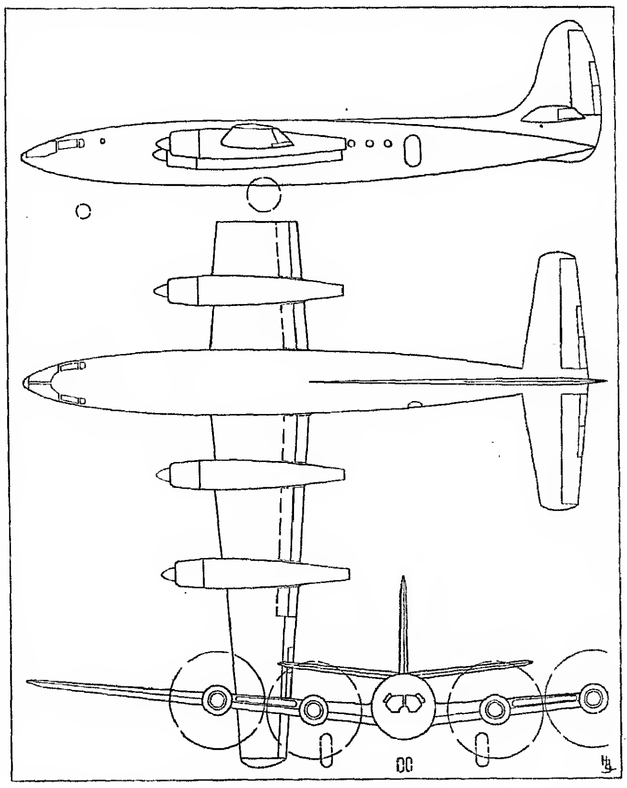
The RC-2 Rainbow is a commercial development of the XF-12, flying trials of which were pending at the time of writing, and differs from it in having a fully-pressurized fuselage with accommodation for 46 passengers and a crew of seven. The fuselage has been lengthened slightly and more powerful Pratt & Whitney R-4360 Wasp-Major engines, (each of approximately 3,250 h.p.) have been installed. Only one exhaust-driven turbine is installed in the rear of each engine nacelle. The fuel capacity is 5,500 U.S. gallons (20,820 litres), which will enable the Rainbow to fly from New York to Paris non-stop, with full load.

Pan American World Airways has ordered six Rainbows and holds an option for a further twelve. An order for twenty placed by American Airlines in 1946 has since been cancelled.

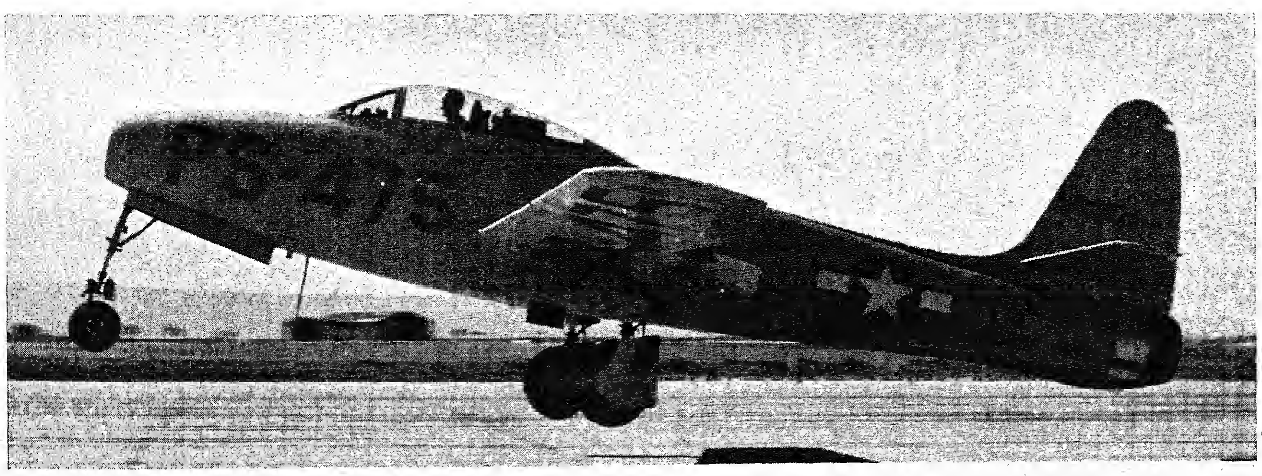
Dimensions.—As XF-12, except length 98 ft. 9 in. (30.1 m.).

Weights and Loadings (Designed).—Weight empty 66,980 lbs. (30,382 kg.), Weight loaded 114,200 lbs. (51,800 kg.), Payload 10,000 lbs. (4,536 kg.) for 4,100 miles (6,598 km.), Wing loading (at loaded weight) 69.6 lbs./sq. ft. (349.8 kg./sq. m.), Power loading (approximate) 8 lbs./h.p. (3.62 kg./h.p.).

Performance (Estimated).—Maximum speed 450 m.p.h. (724 km.h.) at 40,000 ft. (12,190 m.), Cruising speed 400 m.p.h. (644 km.h.) at 40,000 ft. (12,190 m.), Stalling speed 104 m.p.h. (167 km.h.), Rate of climb at sea level 1,680 ft./min. (512 m./min.), Rate of climb on two engines at 5,000 ft. (1,525 m.) 320 ft./min. (97.5 m./min.), Service ceiling 41,000 ft. (12,500 m.), Maximum range 4,100 miles (6,598 km.), Take-off distance to 50 ft. (15 m.) 1,650 yds. (1,509 m.), Landing distance from 50 ft. (15 m.) 1,183 yds. (982 m.).

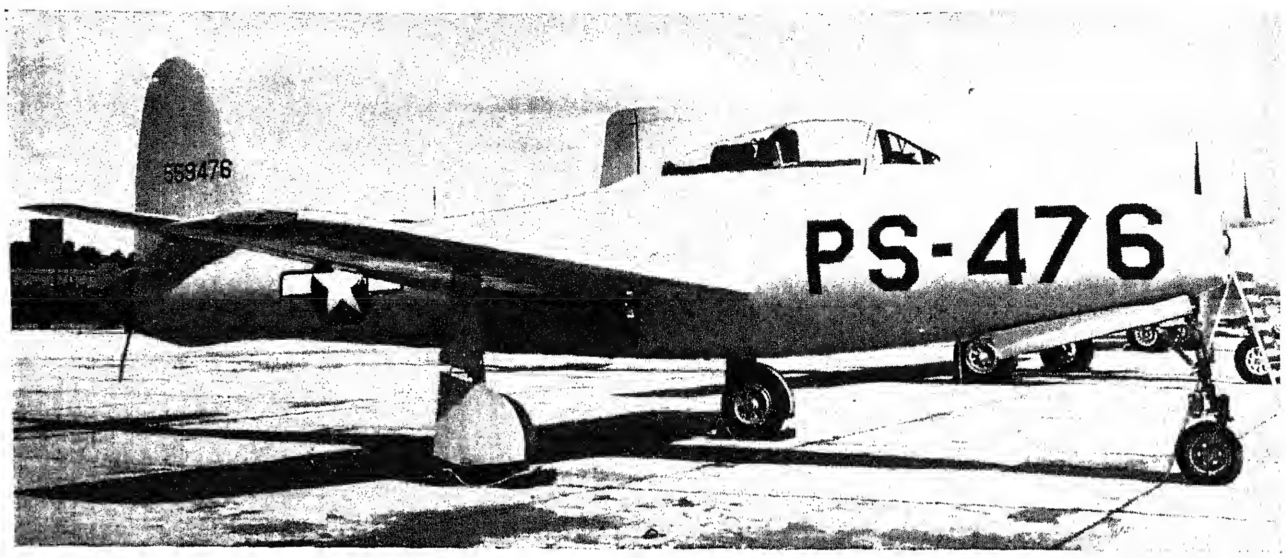


The Republic RC-2 Rainbow.



The Republic XP-84 Thunderjet Single-seat Fighter (General Electric TG-180 axial-flow turbo-jet engine).

REPUBLIC—*continued.*



The Republic XP-84 Thunderjet Single-seat Fighter (General Electric TG-180 axial-flow turbo-jet engine).—(*Peter M. Bowers*).

THE REPUBLIC XP-91.

The XP-91 is a rocket-powered interceptor monoplane which is under development for the U.S.A.A.F. It has a designed speed of about 750 m.p.h. (1,200 km.h.) for extremely short duration and a rate of climb of 15,000 ft./min. (4,575 m./min.). No further details are available for publication.

THE REPUBLIC THUNDERJET.

U.S. Army Air Forces designation : P-84.

The Thunderjet was developed under the joint supervision of the Republic company and the U.S.A.A.F. Air Materiel Command. The original conception was a re-design of the P-47 Thunderbolt to take the General Electric TG-180 axial-flow jet engine, but in November, 1944, it was decided to design a completely new aeroplane.

The first prototype XP-84 flew on February 28, 1946, and its performance was such as to encourage the U.S.A.A.F. to attempt an attack on the World's Speed Record. The second prototype was flown over the measured course at Muroc in September, 1946, but the highest speed obtained was 611 m.p.h. (977.6 km.h.), which represents an American speed record but falls short of the World's Record by some 5 m.p.h. (8 km.h.).

The Thunderjet is a low-mid-wing monoplane using a Republic-designed high-speed aerofoil section, and has a single fin and rudder and a retractable tricycle landing gear. It is powered by a General Electric TG-180 (J-35) axial-flow turbo-jet unit with the air intake in the extreme nose and the jet outlet in the tail beneath the rudder. The engine is mounted aft of the wings and the rear section of the fuselage is removable to permit complete replacement of the unit in 50 minutes.

The pilot's pressurized cockpit is situated ahead of the wing leading-edge, and has an electrically-operated bubble canopy. The canopy can be jettisoned and the pilot is provided with an ejection-seat for rapid exit in an emergency. The wing-tips carry racks for long-range drop-tanks.

The Republic company has been awarded contracts for over 500 P-84A Thunderjets.

Dimensions.—Span 36 ft. 5 in. (11.1 m.), Length 37 ft. 3 in. (11.35 m.).

Weights.—Weight empty (approximate) 9,000 lbs. (4,082 kg.), Weight loaded (as fighter) 12,881.5 lbs. (5,843 kg.), (as fighter-bomber) 14,911.5 lbs. (6,764 kg.).

Performance.—Maximum speed 592 m.p.h. (953 km.h.) at sea level, Speed at 30,000 ft. (9,145 m.) 578 m.p.h. (930 km.h.), Service ceiling, over 40,000 ft. (12,190 m.), Range 1,000 miles (1,609 km.).

ROCKET.

ROCKET AIRCRAFT CORPORATION.

Head Office and Works : Fort Worth 6, Texas.
President : L. D. Thomas.
Executive Vice-President : J. Kenneth Marr.
Chairman : Moody L. Young.
Secretary and Treasurer : H. Wallace Sanders.
Research and Development : R. S. Johnson.

Rocket Aircraft Corporation was formed in 1946 by the acquisition of Johnson Aircraft, Inc., by a group of Texas and Mid-Western business men lead by Mr. L. D. Thomas, who had been president of the Rocket Aircraft Sales Corporation, distributors for Johnson Aircraft.

Johnson Aircraft, Inc. was founded by Mr. R. S. Johnson, who conceived the design of the Rocket two/three-seat cabin monoplane in 1941. Since that date this aircraft, which employs a moulded plastic plywood form of construction, has been developed, and in April, 1946, it received its Approved Type Certificate (No. 776).

THE ROCKET 185.

Type.—Two/three-seat Cabin Monoplane.

Wings.—Cantilever low-wing monoplane. Single-spar wooden structure with covering of moulded plastic plywood, over which is a covering of fabric. Incidence wash-out at tips. Wing area 142 sq. ft. (13.19 sq. m.). Mass-balanced ailerons, with controllable trim-tab in starboard surface. Hydraulically-operated ply-covered split-flaps between ailerons and fuselage with maximum depression of 45 degrees.

Fuselage.—Chrome-molybdenum steel-tube structure with moulded plastic plywood sides and turtle deck.

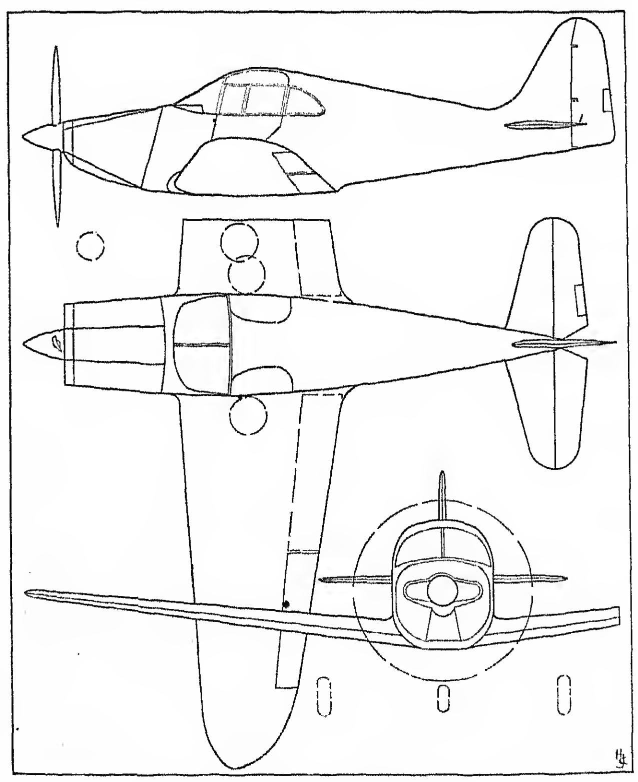
Tail Unit.—Cantilever monoplane type, with statically-balanced rudder and elevators. Controllable trim-tab in rudder and in starboard elevator.

Landing Gear.—Retractable tricycle type. Main wheels carried on single hydraulic shock-absorber legs which retract inwardly into wing. Nose-wheel with hydraulic anti-shimmy dampener carried on forked hydraulic shock-absorber leg retracts backwards into fuselage. Hydraulic operation. Toe-operated hydraulic brakes on main wheels. Track 9 ft. 2 in. (2.79 m.).

Power Plant.—One 185 h.p. Lycoming O-435 six-cylinder horizontally opposed direct-drive air-cooled engine driving Aeromatic two-blade constant-speed airscrew. Fuel capacity 56 U.S. gallons (209 litres), Oil capacity 3 U.S. gallons (11 litres).

Accommodation.—Enclosed cabin for pilot (on port) and one or two passengers, all side-by-side. Maximum cabin width 3 ft. 7 in. (1.09 m.). Access door on each side. Baggage compartment, with allowance of 90 lbs. (41 kg.), at rear of cabin.

Dimensions.—Span 31 ft. 0 in. (9.45 m.), Length 21 ft. 7 in. (6.58 m.), Height (on ground, over cabin) 7 ft. 0 in. (2.13 m.).



The Rocket 185 Cabin Monoplane.

The Rocket 185 Two-seat Light Monoplane (185 h.p. Lycoming engine).

Weights and Loadings.—Weight empty 1,550 lbs. (703 kg.), Useful load 900 lbs. (408 kg.), Weight loaded 2,450 lbs. (1,111 kg.), Wing loading 18 lbs./sq. ft. (87.89 kg./sq. m.), Power loading 13.24 lbs./h.p. (6.89 kg./h.p.).

Performance.—Cruising speed 185 m.p.h. (298 km.h.), Landing speed 54 m.p.h. (87 km.h.), Rate of climb 2,000 ft./min. (610 m./min.), Service ceiling 24,500 ft. (7,470 m.), Cruising range 925 miles (1,487 km.).

ROHR.

ROHR AIRCRAFT CORPORATION.

Head Office and Works: Chula Vista, California.
President and General Manager: Fred H. Rohr.
Executive Vice-President: J. E. Rheim.
Secretary: S. W. Shepard.
Treasurer: G. M. Harrington.

The Rohr Aircraft Corpn. was, during the war, primarily engaged in the large-scale production of complete power-plant assemblies for Consolidated Vultee, and latterly was responsible for the engine nacelles for the Lockheed Constellation. It also undertook the conversions of the Consolidated Vultee PB2Y-3 and 5 patrol-bombers into PB2Y-3R and 5R transports.

Since the war the company has developed in collaboration with the Wright Aeronautical Corpn. a self-contained quickly-detachable power-egg housing the new Wright 9HD Cyclone engine.

The Rohr Aircraft Corpn. has designed and built a novel two-seat personal aircraft with a "tadpole" fuselage and "butterfly" tail, which has flown, and designed and begun the construction of an unconventional "tail-first" light aeroplane, brief details of which follow. No details of the first-mentioned aircraft were available for publication at the time of closing for press.

THE ROHR M.O.1.

The M.O.1 is a two-seat "tail-first" monoplane which has been designed by Mr. B. F. Haynes, Tooling Superintendent of the Rohr Corporation. The crew of two is accommodated side-by-side in an egg-shaped nacelle from which a short conical boom extends forward to carry the longitudinal control surface.

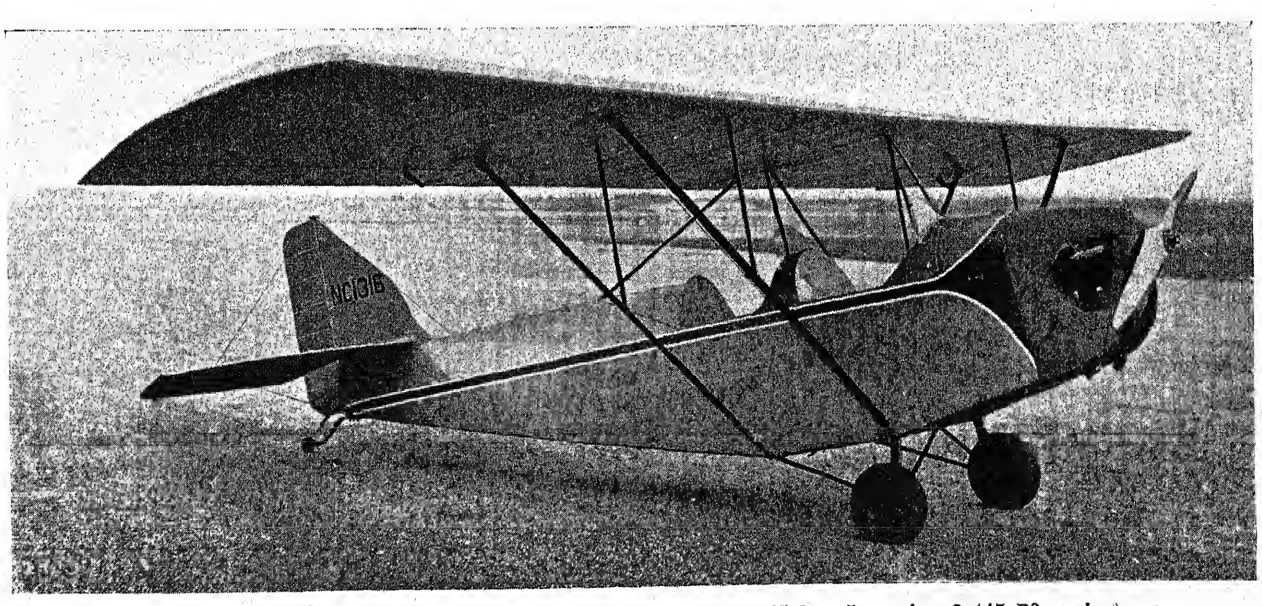
The shoulder wing is of laminar-flow aerofoil section and carries fixed end-plates at the extremities. A fully retractable landing-gear is fitted.

A small air-cooled engine is located in the aft end of the nacelle and drives a pusher propeller. The engine also drives a centrifugal air blower to provide pressurised air for the control system through ducts in the wings and fuselage. A system of fuselage boundary layer control in which the engine cooling air is taken in through a circumferential slot is claimed to provide considerable fuselage drag reduction as well as improved airflow to the propeller.

The control system consists of full-span slots at 80 per cent. of the chord with a constant flow of pressurised air into the boundary layer. Rotation of the control wheel to the left, for example, partially closes a flapper valve in the air duct leading to the left wing. This stops the flow of boundary layer air, thereby lowering the lift of the wing and moving the C.P. forward. Simultaneously, the lift of the right wing is increased and the C.P. moves aft, both accompanied by a differential jet effect of the boundary layer slot which provides the yawing moment to turn the aeroplane. Longitudinal control is obtained by the forward surface, the elevator portion of which is also provided with a full-span pressure-slot device.

The prototype M.O.1 was approaching completion in the Summer of 1946, but lack of a suitable engine has held up completion.

ROSS.



The Ross RS-2L Two-seat Open Cockpit Parasol Monoplane (65 h.p. Lycoming O-145-B3 engine).

ROSS—*continued.*

ROSS AIRCRAFT CORPORATION.

Head Office: 420 Lexington Avenue, New York 17, N.Y.
President: Orrin E. Ross.
Secretary-Treasurer: F. A. Ross.
Sales Manager: R. F. Lowe.

The Ross Aircraft Corporation produces the RS-2L light parasol monoplane, which is a development of the RS-1 powered by a 40 h.p. Continental engine. The RS-1 was issued C.A.A. type certificate No. 732 in August, 1940, but the outbreak of war prevented its production. The new Model RS-2L is designed to provide an aircraft with low cost and simplicity of structure as its main features, and is the only two-seat aircraft on sale in the United States for less than $1,500. It received its A.T.C. on February 5, 1942.

THE ROSS RS-2L.

Type.—Two-seat Light Open-cockpit Parasol monoplane.

Wings.—Strut-braced high-wing parasol monoplane. Aerofoil section Clark Y. Two spar structure built in two sections and attached by bolts to steel-tube *cabane*. Rectangular-section spruce spars and spruce cap-strip ribs with plywood stiffeners. Solid spruce compression ribs with lightening holes. Fabric covering. Chrome-molybdenum steel-tube bracing struts of streamlined section with adjustable ends. Internal steel-wire drag bracing. Wing chord 5 ft. 0 in. (1.24 m.); gross wing area 147 sq. ft. (13.65 sq. m.); aspect ratio 6.1. Wooden ailerons with fabric covering. Aileron area (total) 13.5 sq. ft. (1.254 sq. m.).

Fuselage.—Welded chrome-molybdenum steel-tube structure with fabric covering. Four main longerons, tapering to three aft of rear cockpit.

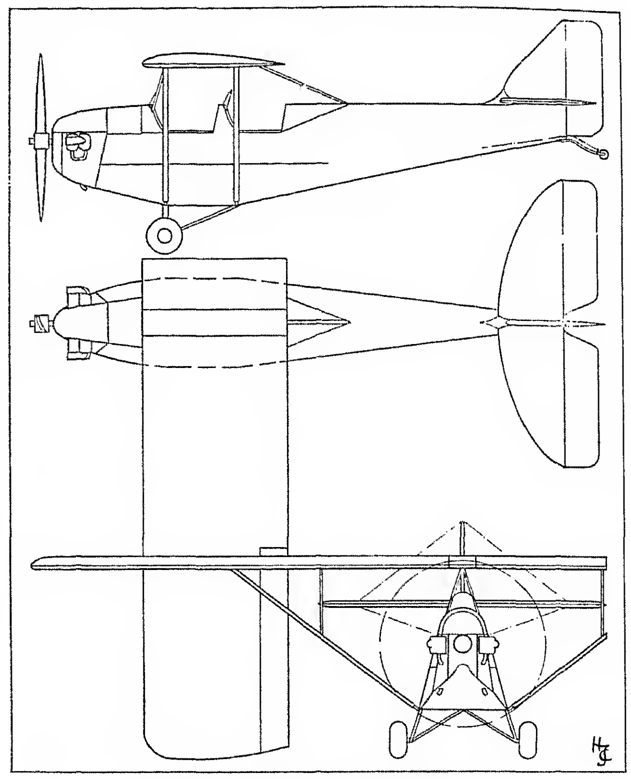
Tail Unit.—Wire-braced monoplane structure. Tailplane and fin have steel-tube frames and fabric covering. Rudder and elevators of sheet duralumin riveted to steel torsion tubes. Tailplane incidence adjustable on ground only. Tailplane span 10 ft. 2 ins. (3.1 m.); tailplane area 15.12 sq. ft. (1.42 sq. m.); fin area 3.85 sq. ft. (.357 sq. m.); rudder height 4 ft. 2 in. (1.27 m.); rudder area 5.67 sq. ft. (.526 sq. m.); elevator area (total) 10.32 sq. ft. (.97 sq. m.).

Landing Gear.—Fixed divided type, consisting of steel-tube structure welded to fuselage structure and carrying low-pressure air-wheels, which are the only shock-absorption medium. Wheels 16 × 7.3 or 7.00-4. Track 4 ft. 7 in. (1.39 m.). Tail-wheel on tempered steel leaf-spring.

Power Plant.—One Lycoming O-145-B3 four-cylinder horizontally-opposed air-cooled engine developing 65 h.p. at 2,550 r.p.m. and driving two-blade wooden airscrew, 5 ft. 10 ins. (1.77 m.) diameter. 12 U.S. gallon (45 litre) template fuel tank in fuselage deck behind engine. Oil capacity 1 U.S. gallon (3.3 litres) in engine.

Accommodation.—Two open tandem cockpits under wing, with provision for coupe fitting as extra equipment. Seats of sheet aluminium with plywood bottoms. Provision for dual control. Plywood floor to cockpits.

Dimensions.—Span 30 ft. 0 in. (9.14 m.), Length (tail up) 20 ft. 0 in. (6.096 m.), Height (tail up, over wing) 7 ft. 0 in. (2.134 m.).



The Ross RS-2L Light Monoplane.

Weights and Loadings.—Weight empty 555 lbs. (251 kg.), Useful load 440 lbs. (200 kg.), Pay load 192 lbs. (87 kg.), Weight loaded 995 lbs. (451 kg.). Wing loading (fully loaded) 6.76 lbs./sq. ft. (33 kg./sq. m.), Power loading (fully loaded) 15.3 lbs./h.p. (6.94 kg./h.p.).

Performance.—Maximum speed 102 m.p.h. (164 km.h.), Cruising speed 90 m.p.h. (145 km.h.), Landing speed 38 m.p.h. (61 km.h.), Take-off run 380 ft. (116 m.), Rate of climb 500 ft./min. (152 m./min.), Service ceiling 14,000 ft. (4,265 m.), Range at cruising speed 230 miles (370 km.), Endurance at cruising speed 3.16 hours, Fuel comsumption at cruising speed 3.8 gal./hr. (17 litres/hr.), Oil consumption ¼ pint/hr. (1.42 litres/hr.).

ROTOR-CRAFT.

THE ROTOR-CRAFT CORPORATION.

Head Office and Works: 4,358 W. 3rd Street, Los Angeles 5, California.
President: Gilbert W. Magill.

The Rotor-Craft Corpn. has under development the X-2A two-seat helicopter, which is also the subject of a U.S. Army contract under the designation XR-11.

The X-2A incorporates counter-rotating rotors fore and aft surmounting a conventional streamline fuselage, fifty per cent. of which will be glazed with transparent plastic panels for wide visibility. It will be fitted with a 100 h.p. Continental A100 engine. The company is planning to go into production with the civil version of this helicopter in the "not too distant future."

The Rotor-Craft Corpn. also has designs for four, twelve and twenty-four passenger helicopters in the drawing-board stage.

RYAN.

THE RYAN AERONAUTICAL COMPANY.

Head Office and Works: Lindbergh Field, San Diego, California.
President: T. Claude Ryan.
Vice-President and Treasurer: G. C. Woodard.
Vice-President: Earl D. Prudden.
Secretary and Controller: C. A. Stillwagen.
Chief Engineer: Benjamin T. Salmon.
Assistant to President (Contract Administration): Walter O. Locke.
Assistant to President (Engineering-Production Co-ordination): W. Art Mankey.
Sales and Export Manager: Sam C. Breder.

The Ryan Aeronautical Company is a successor to the old Ryan Company which produced the aeroplane in which Mr. Charles Lindbergh made the first non-stop flight from New York to Paris in 1927. Mr. T. Claude Ryan severed his connections with the original Ryan Company in 1927 but he continued to operate the Ryan School of Aeronautics which he had established at San Diego in 1922.

In 1933 he re-entered the manufacturing field and began the development of the Ryan S-T series of low-wing training monoplanes.

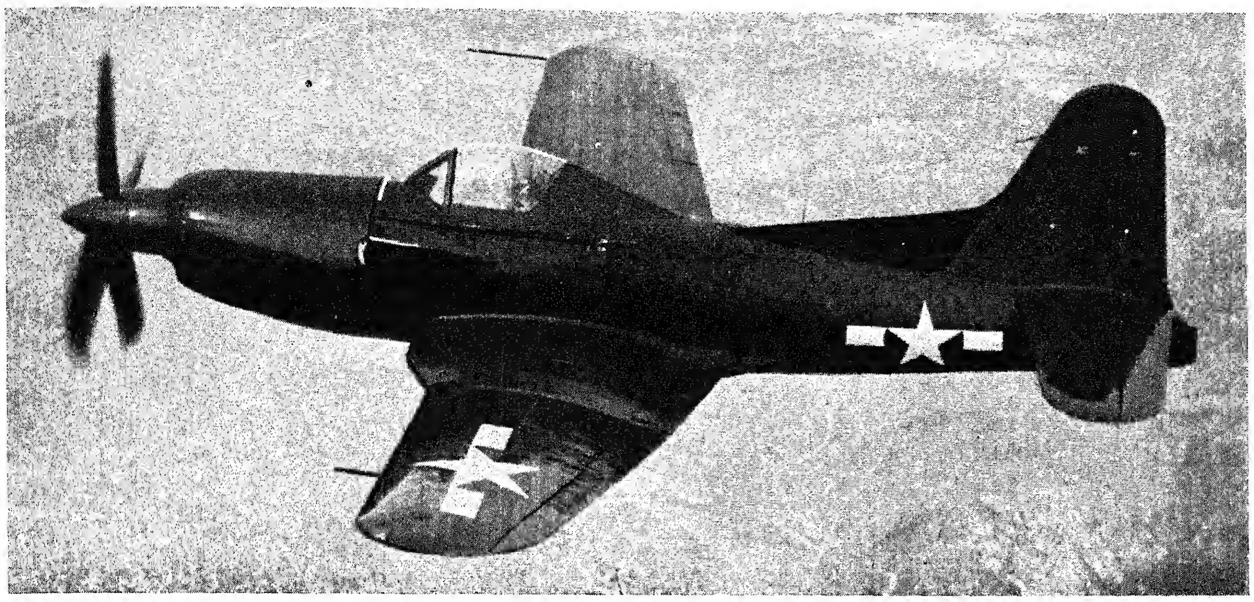
The Ryan Company was one of three firms selected by the Government for the mass-production of military training aircraft under a type standardisation programme and was the first company to manufacture in quantity an all-metal low-wing primary trainer. The S-T (PT-16 and PT-20) was the first low-wing monoplane trainer to satisfy Army requirements, and this model was followed by the ST-3 (PT-21 and PT-22). Over 1,300 aircraft of these types were built, and many have been acquired for civilian flying from surplus Army stocks since the end of the war. Large numbers of Ryan trainers were also supplied to the Air Forces of the Netherlands East Indies, Guatemala, China, Honduras, Mexico, etc. These aircraft have been fully described in previous issues of this Annual.

The ST-3 (PT-22) was in production until 1942 when the Ryan Company, as the result of a request to undertake studies towards the conversion of the PT-22 all-metal trainer to non-strategic materials in order to release essential metals for more urgent purposes, produced the experimental ST-4 (PT-25) a two-seat trainer built almost entirely of plastic-bonded wood. This aircraft was described and illustrated in the 1943-44 issue of this Annual.

In 1943 the Navy asked the Ryan Company to undertake the design and production of a new fighter which would combine for the first time a conventional engine and airscrew with a jet propulsion unit. While development of this aircraft, the FR-1 Fireball, proceeded manufacturing facilities were devoted to building major components for various Army and Navy combat and transport aircraft. The exhaust manifold department was also in peak production.

Orders totalling more than $100,000,000 were received for the Fireball from the U.S. Navy, and first deliveries were issued to Combat Evaluation Fighter Squadron VF-66 in 1945. The Fireball was too late to be used operationally during the war but deliveries on a very reduced scale have been continued. The company has developed a more advanced version, the Model 30 or XF2R-1, in which the forward internal combustion engine has been replaced by a turbine-driven airscrew.

The Ryan Aeronautical Company operates a 43-acre manufacturing plant at San Diego and in addition to the XF2R-1



The Ryan XF2R-1 Single-seat Fighter (General Electric TG-100 airscrew-jet and I-16 thermal jet engines).

fighter, various other designs are being developed for both the Army and the Navy. Although commercial or private aircraft production had not at the time of writing been resumed, extensive design studies and market surveys are being conducted.

THE RYAN MODEL 30.

U.S. Navy designation : XF2R-1.

The XF2R-1 is a development of the RF-1 Fireball, the principal change being in the use of a General Electric TG-100 airscrew gas-turbine in the nose in place of the reciprocating engine of the Fireball.

The new nose section enclosing the TG-100 engine results in an increase in the overall length of the XF2R-1 by some 4 ft. (1.22 m.), which, in turn, calls for increased vertical fin area aft, provided by a dorsal extension to the standard FR-1 fin.

Wings, rear fuselage (including the General Electric I-16 thermal jet engine exhausting aft of the tail), landing-gear and tail-unit (less dorsal fin) are the same as for the FR-1.

About three-fourths of the available power of the TG-100 engine is absorbed by a four-blade square-tipped Hamilton Standard airscrew, the remaining one-fourth being supplied by the thrust of the jet exhaust system which is ducted into troughs on each side of the fuselage just below the pilot's cockpit.

The XF2R-1 is serving as a flying laboratory to obtain operational experience with the TG-100 engine, its airscrew and other engine accessories.

THE RYAN MODEL 28 FIREBALL

U.S. Navy designation : FR.

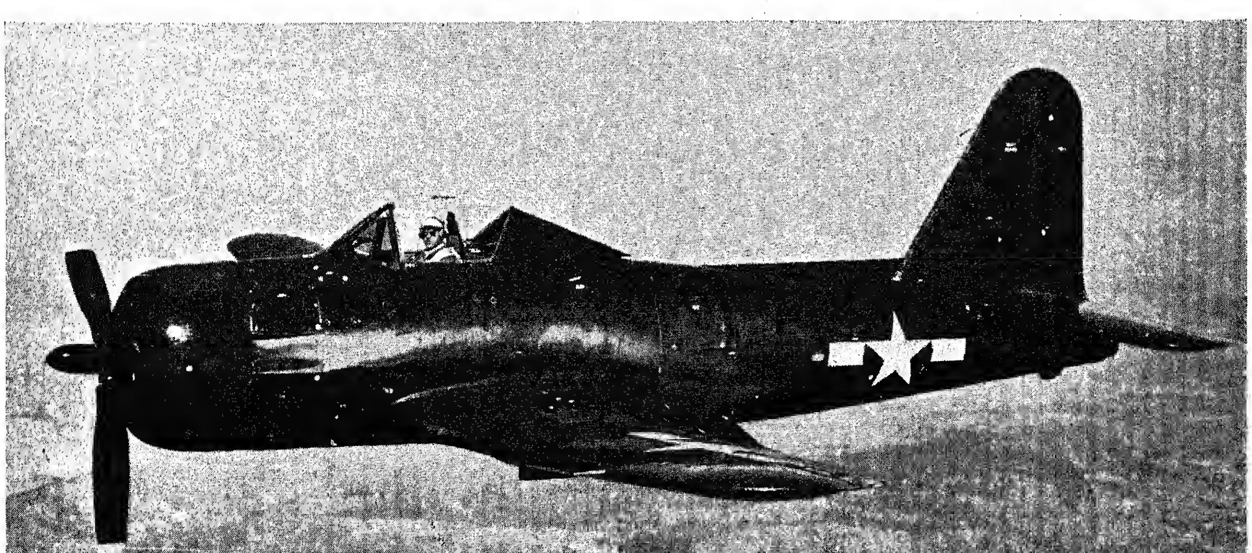
The Fireball is the first aircraft to be put into production which uses a combined power-plant of a conventional engine driving an airscrew and a jet-propulsion unit. Design work was commenced in 1943 and production was proceeding at the time of the Japanese capitulation. On November 6, 1945, a Fireball, with its nose engine unserviceable, made a successful landing on U.S. aircraft-carrier *Wake Island* off San Diego using only its rear jet unit, and this is claimed to be the first occasion on which a pure jet landing was made on a carrier.

The prototype XFR-1 was powered by a Wright R-1820-56 engine and a General Electric I-16 jet unit. The first production version was the FR-1 which was fitted with an R-1820-72W and an I-16. The FR-2 has an R-1820-74W and an I-16, and the FR-3 is powered by an R-1820-74W and a General Electric I-20 jet unit.

TYPE.—Single-seat Fighter monoplane using both conventional tractor airscrew and a jet propulsion unit.

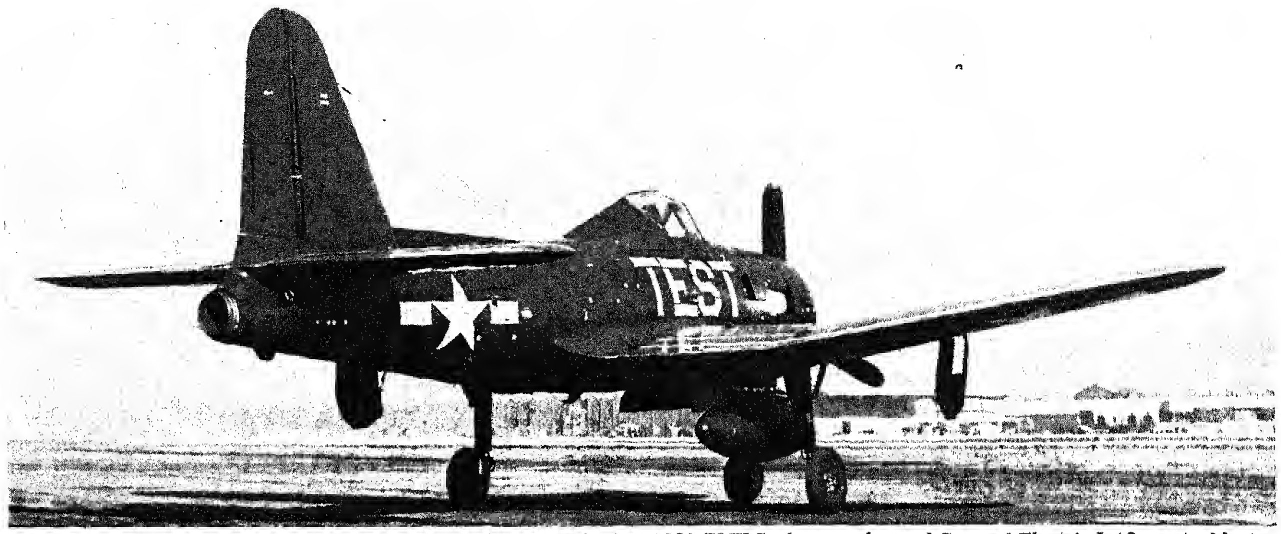
WINGS.—Low-wing cantilever monoplane of all-metal construction. Laminar flow NACA aerofoil section. Wing of aluminium-alloy built in three sections; centre-section integral with fuselage, and two outer panels which fold upwards hydraulically for stowage. Centre-section built up of two I-section spars, spanwise Z-section stringers, former ribs and flush-riveted metal skin. Outer panels of similar spar construction, semi-monocoque from root to ailerons and full monocoque to tips. Aerodynamically, dynamically and statically-balanced all-metal ailerons. Trim-tab in port aileron. Fowler-type flaps in four sections between ailerons and wing roots.

FUSELAGE.—All-metal structure in two main portions. Forward section of semi-monocoque construction built up on four main longerons with vertical frames and formers stiffened and braced where required. Flush-riveted metal skin. Readily interchangeable rear portion is a monocoque structure and attaches to forward section at points just aft of wing. Firewall of .051 in. (.129 cm.) aluminium-alloy sheet riveted to frame ahead of cockpit. Forward fuselage armoured with face-hardened steel plate and aluminium-alloy plate and sheet. Deck cowling ahead of cockpit of heavy aluminium plate.



The Ryan FR-1 Fireball Single-seat Fighter flying on its jet engine only.

***RYAN**—continued.*



The Ryan FR-1 Fireball Single-seat Fighter (1,350 h.p. Wright R-1820-72W Cyclone engine and General Electric I-16 gas-turbine).

Tail Unit.—All-metal cantilever structure with stressed metal skin over all surfaces. Elevators and rudder aerodynamically, dynamically and statically-balanced. Trim-tabs in elevators and rudder. Dorsal fin integral with fuselage.

Landing Gear.—Tricycle type. Main wheels, of die-cast heat-treated magnesium with Timken roller bearings, are carried on oleo-pneumatic shock-absorber legs attached to front spar at outer ends of centre-section, and retract outwards into outer wing sections and are completely enclosed. Goodyear high-pressure channel-tread tyres and brakes. Self-castering, non-steerable nose-wheel carried in forked shock-absorber leg retracts backwards into fuselage. Hydraulic shimmy-damper and self-aligning device. Firestone low-profile nose-wheel tyre. Hydraulic operation. Wheel base 7 ft. 2 in. (2.2 m.). Retractable self-aligning deck arrester hook. Hydraulic operation.

Power Plant.—Combination of conventional engine driving tractor airscrew and gas turbine exhausting aft of the tail unit. Each engine completely independent. Forward unit in FR-1 is a Wright Cyclone R-1820-72W nine-cylinder radial air-cooled engine rated at 1,350 h.p. at 2,700 r.p.m. for take-off. Curtiss-Electric three-blade full-feathering, constant-speed airscrew, 10 ft. (3.05 m.) diameter. Electric starter. Rear engine is a General Electric I-16 or I-20 jet propulsion unit mounted in the forward end of the aft section of the fuselage and ejecting at extreme stern. Air intakes in leading edge of centre-section. Two self-sealing fuel tanks; one of 125 U.S. gallons (473 litres) in top portion of fuselage behind cockpit, and one of 51 U.S. gallons (191 litres) under cockpit floor immediately aft of firewall. One 100 U.S. gallon (377 litres) drop-tank may be carried under starboard centre-section. Oil capacity 15 U.S. gallons (57 litres).

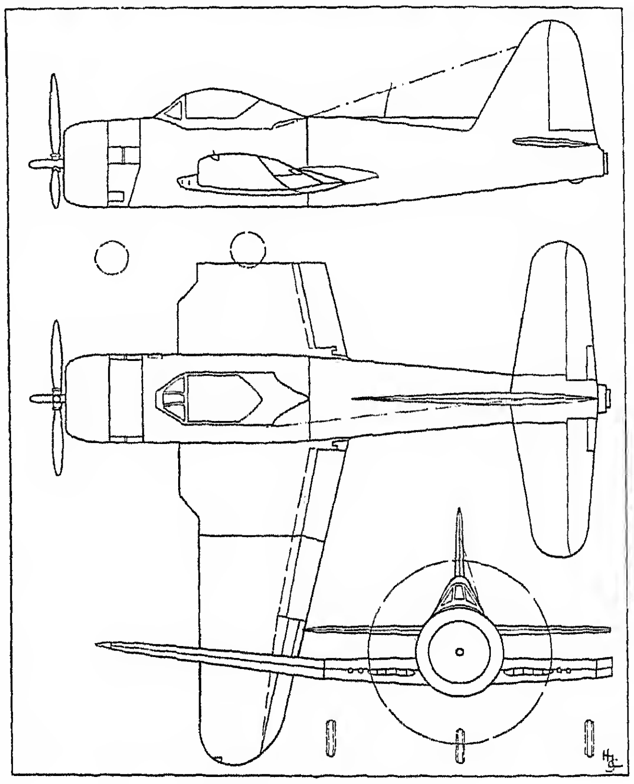
Accommodation.—Pilot's cockpit over leading-edge of centre-section. Moulded plastic canopy slides on roller bearings. Emergency jettisonable release. Three-panel windscreen in aluminium alloy channel frame, the front panel of laminated bullet-proof glass 1½ in. (3.8 c/m.) thick. Cockpit back armour of $\frac{5}{16}$ in. (.79 c/m.) and ⅜ in. (.94 cm.) steel plate welded together.

Armament.—Four .5 in. (12.7 m/m.) Browning machine-guns, two in each centre-section outboard of air intakes. 1,200 rounds of ammunition carried in wells inboard of guns. Racks for two 1,000 lb. (454 kg.) bombs, one under each centre-section, and racks for two zero-length rocket projectiles under each outer panel. Special Night fighter equipment (FR-1N) may be installed.

Dimensions.—Span 40 ft. 0 in. (12.19 m.), Width folded 17 ft. 6 in. (5.34 m.), Length 32 ft. 4 in. (9.85 m.), Height (on ground, over rudder) 13 ft. 7 in. (4.15 m.), Height folded 16 ft. 9 in. (5.1 m.).

Weights.—Weight empty 7,635 lbs. (3,470 kg.), Weight loaded 9,862 lbs. (4,480 kg.).

Performance (Using both engines).—Maximum speed 425 m.p.h. (860 km.h.) at 18,000 ft. (5,490 m.), Initial rate of climb 4,800 ft./min. (1,465 m./min.), Climb to 10,000 ft. (3,050 m.) 2.4 min., Climb to 20,000 ft. (6,100 m.) 5.6 min., Service ceiling 40,000 ft. (12,200 m.), Normal cruising range 1,030 miles (1,650 km.), Range at cruising speed with drop-tank 1,430 miles (2,290 km.), Maximum speed with front engine only 320 m.p.h. (515 km.h.), Maximum speed with jet unit only 300 m.p.h. (483 km.h.).



The Ryan FR-1 Fireball.

SCHWEIZER.

SCHWEIZER AIRCRAFT CORPORATION.

Head Office and Works: Chemung County Airport, Elmira, N.Y.

President and Chief Engineer: Ernest Schweizer.

Vice-President and General Manager: Paul A. Schweizer.

Secretary: Robert P. McDowell.

The Schweizer Aircraft Corpn. specialises in the design and construction of gliders and sailplanes. It also manufactures parts and assemblies for other aircraft companies under sub-contract. The company furthermore maintains a complete aircraft and glider overhaul and repair service and does work in the heat treatment and processing of aluminium and in magnaflux inspection.

This Corporation has produced the SGS 2-8 and SGS 2-12 Sailplanes, both of which were used for training purposes by the U.S. Army, and many of which have now been disposed of for civilian use.

The SGU 1-19 Utility Glider is now available in kit form. All major structural components are built and all welding is done by the manufacturers, and only a limited knowledge of woodwork, fabric-covering and aircraft assembly is necessary for the purchasers.

The latest product of the Schweizer Corporation is the SGS 2-22 Utility Sailplane, a description of which follows.

THE SCHWEIZER SGU 2-22 SAILPLANE.

Type.—Two-seat Utility Sailplane.

Wings.—Semi-cantilever strut-braced high-wing monoplane. Constant-chord structure with metal D-tube leading-edge ahead of spar and fabric covering aft. Wing area 210 sq. ft. (19.51 sq. m.).

Fuselage.—Welded chrome-molybdenum steel-tube structure with fabric covering.

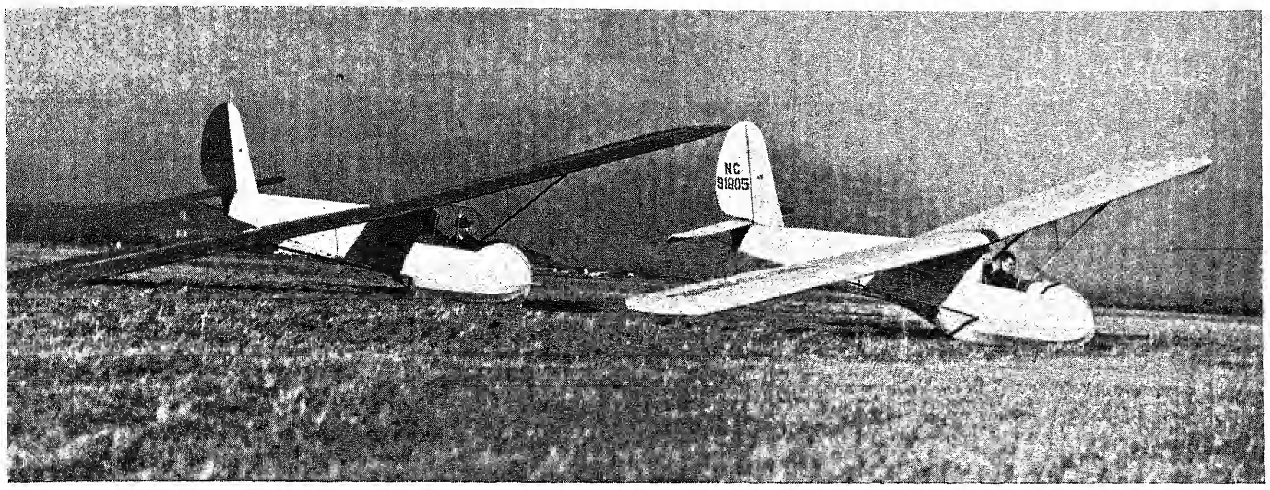
Tail Unit.—Cantilever monoplane type. Fin and rudder of duralumin construction with fabric covering. Strut-braced tailplane and elevators of steel-tube framework with fabric covering.

Landing Gear.—Unsprung single-wheel with mechanical disc-type brake mounted on fuselage centre-line, with single skid on rubber blocks ahead of wheel. Rubber-mounted tail skid.

Accommodation.—Tandem open cockpits, with provision for transparent enclosure.

Dimensions.—Span 43 ft. 0 in. (13.1 m.), Length 25 ft. ½ in. (7.63 m.).

SCHWEIZER—*continued.*



A Schweizer SGU 2-22 Two-seat Utility Sailplane (left) and an SGU 1-19 Single-seat Training and Soaring Glider.

Weights and Loadings.—Weight empty 450 lbs. (240 kg.); Weight loaded 830 lbs. (376 kg.), Wing loading (solo) 3.05 lbs./sq. ft. (14.89 kg./sq. m.), (dual) 3.95 lb./sq. ft. (19.28 kg./sq. m.).

Performance.—Maximum level speed 89 m.p.h. (143 km.h.), Towing speed 89 m.p.h. (143 km.h.), auto-winch towing speed 66 m.p.h. (106 km.h.), Stalling speed (solo) 27 m.p.h. (43 km.h.), (dual) 30 m.p.h. (48 km.h.), Gliding ratio 18 : 1, Sinking speed (solo) 2.8 ft. per sec. (.85 m. per sec.), (dual) 3 ft. per sec. (.91 m. per sec.).

THE SCHWEIZER SGS 2-8 SAILPLANE.

Type.—Two-seat high-performance all-metal Sailplane.

Wings.—Semi-cantilever shoulder-wing monoplane. Single-strut bracing. Braced portion of wings rectangular, outer cantilever portions tapered with rounded tips. Single aluminium-alloy spar, with metal D leading edge. Aluminium-alloy pressed ribs cantilevered from rear face of spar with fabric covering to trailing edge. Wing area 214 sq. ft. (19.88 sq. m.). Metal-framed fabric-covered ailerons.

Fuselage.—Welded chromo-molybdenum steel-tube structure covered with fabric.

Tail Unit.—Cantilever monoplane type. Framework of formed steel and aluminium-alloy parts and covered with fabric.

Landing-Gear.—Single wheel with friction-type brake rigidly mounted on centre-line with single skid on rubber blocks forward of wheel. Rubber-mounted tail-skid.

Accommodation.—Tandem seats under continuous transparent canopy. Dual controls.

Dimensions.—Span 52 ft. (15.86 m.), Length 25 ft. 3 in. (7.7 m.), Height 6 ft. 10 in. (2.1 m.).

Weights and Loading.—Weight empty 460 lbs. (208.8 kg.), Weight loaded 860 lbs. (390.4 kg.), Wing loading 4.01 lbs./sq. ft. 19.57 kg./sq. m.).

Performance.—Maximum glide, dive or aeroplane tow speed 72 m.p.h. (115.2 km.h.), Maximum auto or winch tow speed 54 m.p.h. (86.4 km.h.), Stalling speed 34 m.p.h. (54.4 km.h.), Gliding ratio 24 : 1.

THE SCHWEIZER SGS 2-12 SAILPLANE.

Type.—Two-seat high-performance Sailplane.

Wings.—Cantilever low mid-wing monoplane. Middle half of wing of rectangular plan form, outer portions tapered with rounded tips. Single cantilever spruce spar, spruce and mahogany plywood ribs, plywood D-tube leading-edge ahead of spar, fabric covering over entire wing. Wing area 237 sq. ft. (22.01 sq. m.). Wooden-framed fabric-covered ailerons. Spoilers above and below wing inboard of ailerons.

Fuselage.—Welded chrome-molybdenum steel-tube structure covered with fabric.

Tail Unit.—Cantilever monoplane type. Spruce framework, mahogany plywood leading-edges to fin and tailplane and fabric covering over all. Trim-tabs in rudder and port elevator.

Landing Gear.—Unsprung single wheel with mechanical disc-type brake on centre-line with rubber-mounted single skid forward of wheel. Rubber-mounted tail-skid.

Accommodation.—Tandem seats beneath continuous transparent canopy. Dual controls.

Dimensions.—Span 54 ft. (16.47 m.), Length 27 ft. 7 in. (8.4 m.), Height 8 ft. (2.44 m.).

Weights and Loadings.—Weight empty 820 lbs. (372 kg.), Weight loaded 1,200 lbs. (545 kg.), Wing loading 5.15 lbs./sq. ft. (25.1 kg./sq. m.).

Performance.—Maximum glide, dive or tow speed 100 m.p.h. (160 km.h.), Stalling speed 38 m.p.h. (61 km.h.).

THE SCHWEIZER SGU 1-19 GLIDER.

Type.—Single-seat utility Training and Soaring Glider.

Wings.—High-wing braced monoplane. Wing of parallel chord and constant thickness with parallel bracing struts. All-wood structure with two spruce spars, spruce and mahogany plywood ribs, plywood leading-edge and fabric-covering overall. Wing area 170 sq. ft. (15.79 sq. m.).

Fuselage.—Welded chrome-molybdenum steel-tube framework covered with fabric.

Tail Unit.—Braced monoplane type. Horizontal surfaces of welded steel-tube covered with fabric. Vertical surfaces may be of fabric-covered wooden construction (when supplied in kit form for schools) or of fabric-covered steel and aluminium-alloy construction (when completed in factory).

Landing Gear.—Single unsprung wheel mounted on centre-line with single skid on rubber blocks ahead of the wheel. Rubber-mounted tail-skid.

Accommodation.—Single open cockpit with optional transparent enclosure.

Dimensions.—Span 36 ft. 8 in. (11.2 m.), Length 20 ft. 7½ in. (6.3 m.), Height 10 ft. 4½ in. (3.2 m.).

Weights and Loadings.—Weight empty 320 lbs. (145.3 kg.), Weight loaded 550 lbs. (249 kg.), Wing loading 3.23 lbs./sq. ft. (15.77 kg./sq. m.).

Performance.—Maximum tow speed 75 m.p.h. (120 km.h.), Maximum gliding speed 75 m.p.h. (120 km.h.), Stalling speed 28 m.p.h. (45 km.h.), Gliding ratio 17 : 1, Sinking speed 3 ft./sec. (.91 m./sec.).

SKYCRAFT.

SKYCRAFT INDUSTRIES, INC.

Head Office : Venice, California.

This Company has designed the Skycraft Model 447 four/five-seat twin-boom pusher monoplane, a specification of which follows.

THE SKYCRAFT MODEL 447.

Type.—Four/five-seat twin-boom Pusher monoplane.

Wings.—Cantilever low-wing monoplane. All-metal structure in three main sections consisting of centre-section carrying nacelle and tail-booms and two outer wings. All-metal ailerons and hydraulically-operated trailing-edge flaps. Wing area 180 sq. ft. (16.72 sq. m.).

Nacelle and Tail Booms.—All-metal semi-monocoque structures; tail-booms extend aft from wing centre-section to carry tail-unit.

Tail Unit.—Cantilever all-metal structure consisting of constant-chord tailplane and one-piece elevator between booms, and twin fins and rudders.

Landing Gear.—Retractable tricycle type. Main wheels (Firestone 7.00 × 6) carried on pneumatic and rubber shock-absorber legs retract into wing. Hydraulic operation. Track 9 ft. (2.74 m.). Hydraulic brakes. Firestone nose-wheel retracts into fuselage.

Power Plant.—One Lycoming six-cylinder horizontally-opposed air-cooled engine rated at 190 h.p. at 2,550 r.p.m. mounted at rear of nacelle as pusher unit and driving two-blade adjustable-pitch propeller. Fuel capacity 50 U.S. gallons (189 litres) in two centre-section tanks, one on each side of fuselage.

Accommodation.—Enclosed cabin seating pilot (on port) and one passenger side-by-side with dual controls, and full-width seat aft for three passengers side-by-side. Front seat width 4 ft. 11 in. (1.19 m.), rear seat width 4 ft. 4 in. (1.32 m.). Access door on each side. Plexiglas windscreen and side windows. Compartment for 100 lbs. (45 kg.) of baggage aft of rear seats.

Dimensions.—Span 36 ft. (10.97 m.), Length 26 ft. 3 in. (8 m.), Height 7 ft. 4 in. (2.23 m.).

Weights and Loadings (Designed).—Weight empty 1,510 lbs. (685 kg.), Disposable load 1,290 lbs. (585 kg.), Weight loaded 2,800 lbs. (1,270 kg.), Wing loading 15.56 lbs./sq. ft. (76 kg./sq. m.), Power loading 14.74 lbs./h.p. (6.66 kg./h.p.).

Performance (Estimated).—Maximum speed 162 m.p.h. (261 km.h.), Cruising speed 142 m.p.h. (228 km.h.), Stalling speed (with flaps) 49 m.p.h. (79 km.h.), Stalling speed (without flaps) 65 m.p.h. (105 km.h.), Initial rate of climb 940 ft./min. (286 km.h.), Service ceiling 16,000 ft. (4,875 m.), Cruising range 715 miles (1,151 km.), Take-off run 168 yds. (154 m.), Landing run 100 yds. (91 km.h.), Fuel consumption 11.8 U.S. gallons/hr. (44.6 litres/hr.).

SOUTHERN.

SOUTHERN AIRCRAFT DIVISION OF THE PORTABLE PRODUCTS CORPORATION.

Head Office and Works: Garland, Texas.

General Manager: Willis C. Brown.
Director of Engineering: W. M. Mullings.
Director of Manufacturing: A. E. Worley.
Chief Aeronautical Engineer: Arthur R. Lardin.

In 1940 the Southern Aircraft Corpn. completed the BM-10 two-seat training biplane which was designed to conform to the requirements of the U.S. Army Air Forces. This type has not been proceeded with.

In the latter part of 1940 the Company began the construction of a new works and aerodrome at Garland and the first part of the plant was ready for occupation early in 1941.

The manufacturing facilities of the Company were then devoted to the production of aircraft components for the leading types of U.S. combat aircraft, including the Consolidated Vultee B-24 Liberator, and the Grumman Avenger and Hellcat. By the end of 1944 the plant of the Southern Aircraft Corpn. was five times its original size.

The Corporation was subsequently acquired by the Portable Products Corporation of which it now forms a Division.

The Corporation has now produced a twin-engined six-seat monoplane known as the Southernaire Model II. A description of this aircraft follows.

Another type being developed is the "Roadable," a combined aircraft and automobile, brief particulars of which are given hereafter.

THE SOUTHERNAIRE MODEL II.

Type.—Twin-engined six-seat Cabin monoplane.

Wings.—Cantilever high-wing monoplane with constant-chord centre-section and two tapered outer wings. Metal spars and ribs and sheet metal covering. Fabric-covered metal-framed ailerons and hydraulically-operated trailing-edge flaps. Wing area 251 sq. ft. (23.32 sq. m.).

Fuselage.—All-metal semi-monocoque structure.

Tail Unit.—Cantilever monoplane type. All-metal framework and metal covering. Trim-tabs in rudder and elevators. Tailplane span 14 ft. 8 in. (4.47 m.).

Landing Gear.—Retractable tricycle type. Main wheels (Hayes 8.50 × 10) carried on oleo shock-absorber legs attached to fuselage retract into sides of fuselage leaving small portion projecting. Smooth metal fairing aft of wheel. Hydraulic operation. Track 7 ft. 10¼ in. (2.39 m.). Nose-wheel retracts into fuselage leaving small portion projecting.

Power Plant.—Two Ranger 6-440-C-5 six-cylinder in-line inverted air-cooled engines each rated at 200 h.p. at 2,450 r.p.m. mounted high on wing leading-edge and driving Beech-Roby two-blade adjustable-pitch wooden airscrew.

Accommodation.—Enclosed cabin with six individual seats arranged in pairs, with swing-over dual controls in front. Access door on each side at rear of cabin. Baggage compartments in nose and aft of cabin; total volume 40 cub. ft. (1.13 cub. m.); allowance 200 lbs. (91 kg.).

Dimensions.—Span 42 ft. (12.80 m.), Length 29 ft. 2½ in. (8.91 m.), Height 11 ft. 0⅝ in. (3.35 m.).

Weights and Loadings.—Weight empty 3,179 lbs. (1,441 kg.), Disposable load 1,921 lbs. (871 kg.), Weight loaded 5,100 lbs. (2,312 kg.), Wing loading 20.3 lbs./sq. ft. (99 kg./sq. m.), Power loading 12.7 lbs./h.p. (5.74 kg./h.p.).

Performance.—Maximum speed 175 m.p.h. (282 km.h.), Cruising speed 166 m.p.h. (267 km.h.), Landing speed 61 m.p.h. (98 km.h.), Initial rate of climb 800 ft./min. (244 m./min.), Service ceiling 19,000 ft. (5,790 m.), Cruising range 760 miles (1,223 km.), Take-off run 283 yds. (259 m.), Landing run 150 yds. (137 m.), Fuel consumption 19.66 U.S. gallons/hr. (74.4 litres/hr.) per engine.

THE SOUTHERNAIRE ROADABLE.

The Roadable is a single-engined twin-boom high-wing monoplane the main nacelle of which can be detached from the wings and tail booms and can be used as an orthodox automobile. The prototype was designed by Mr. Theo P. Hall, now in charge of design and research at the Consolidated Vultee Aircraft Corporation, and first flew in 1939 at San Diego. At the time of writing it was still in the experimental stage.

The Roadable is powered by a 130 h.p. Franklin 6AC-298-F3 six-cylinder horizontally-opposed air-cooled engine driving a tractor airscrew, and has a fixed tricycle landing gear which also serves on the road. The enclosed cabin seats two side-by-side.

Dimension.—Span 30 ft. 0 in. (9.14 m.).

Weight Loaded.—1,800 lbs. (816 kg.).

Maximum Speed (Estimated).—128 m.p.h. (206 km.h.). Range 310 miles (499 km.).

SIKORSKY.

SIKORSKY AIRCRAFT DIVISION OF THE UNITED AIRCRAFT CORPORATION.

Head Office and Works: South Avenue, Bridgeport, Conn.

General Manager: B. L. Whelan.
Engineering Manager: Igor I. Sikorsky.
Chief Engineer: Michael E. Gluhareff.
Assistant Engineering Manager: Serge E. Gluhareff.
Factory Manager: John L. Brown, Jr.
Assistant Secretary: Richard T. Horner.
Assistant Treasurer: R. A. Aspinwall.

In January, 1943, the Chance Vought and Sikorsky Divisions of the former Vought-Sikorsky Division of the United Aircraft Corpn. were reconstituted as separate manufacturing divisions to enable Chance Vought to devote all its energies to the development and production of combat aircraft, while the Sikorsky Division concentrates on the development of the helicopter for both military and civil purposes.

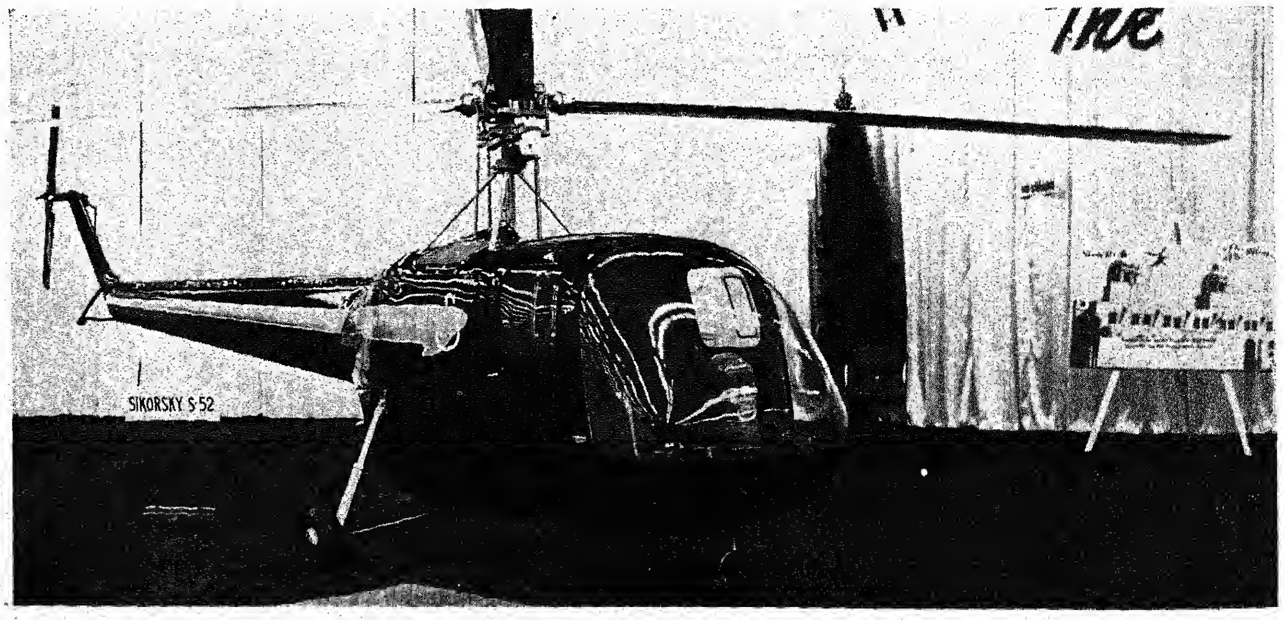
Sikorsky Aircraft moved from Stratford to Bridgeport Conn., where a leased factory was occupied, tooled-up and put into production. One of the features of the new plant was "the smallest airport in the World," an area just outside the factory about the size of an automobile park from which the products of the company were flown.

The original Sikorsky helicopter—the experimental VS-300—was placed in the Edison Museum in Dearborn, Mich., in 1943.

The first helicopter built for military service—the experimental XR-4—first flew on January 13, 1942. On the basis of successful tests with this aircraft, a limited production order for a progressive development known as the YR-4 was placed with Sikorsky Aircraft. Subsequently a production order for 100 R-4Bs was given.

Two other Sikorsky designs were put into production before VJ-Day, the R-5A by Sikorsky Aircraft, and the R-6A by the Nash-Kelvinator Corpn. under Sikorsky licence.

Since VJ-Day Sikorsky has produced the S-51, a civil version of the R-5 with an enlarged cabin to accommodate four persons.



The Sikorsky S-52 Two-seat Helicopter (178 h.p. Franklin engine).—(*Martin & Kelman*)

***SIKORSKY**—continued.*

The Sikorsky S-51 Four-seat Commercial Helicopter (450 h.p. Pratt & Whitney R-985 Wasp-Junior engine).

This model has been granted its Certificate of Airworthiness and is now in production. A licence for its manufacture in the United Kingdom has been granted to Westland Aircraft, Ltd., of Yeovil, Somerset, England.

THE SIKORSKY S-52.

The S-52 is a new two-seat side-by-side helicopter which has been designed for civil use as well as for military liaison and patrol work. The first specimen was exhibited at the 1946 Cleveland Show, but this aircraft had been completed in six weeks specially for exhibition and it was due to undergo considerable development testing before it flew.

The S-52 is the first U.S. helicopter to be fitted with all-metal rotor blades. Powered by a 178 h.p. Franklin engine, it will have a designed maximum speed of 105 m.p.h. (168 km.h.) and will cruise at 90 m.p.h. (144 km.h.) on 75% power. On a loaded weight of 1,750 lbs. (795 kg.) it is designed to carry a total disposable load of 650 lbs. (295 kg.).

THE SIKORSKY S-51.

The S-51 is a civil development of the R-5 military helicopter and is powered by a Pratt & Whitney R-985 Wasp-Junior nine-cylinder radial engine rated at 450 h.p. at 2,300 r.p.m. at 2,300 ft. (700 m.). It was one of the first helicopters to receive a commercial licence. In general it resembles the earlier military type, but has an enlarged four-seat cabin with a maximum width of 5 ft. 2 in. (1.57 m.). The pilot is situated in front, with the three passengers side-by-side in a large full-width seat aft. The cabin has an internal height of 4 ft. 5½ in. (1.36 m.). A fixed tricycle landing gear with a track of 12 ft. (3.66 m.) is fitted. The maximum fuel capacity is 100 U.S. gallons (379 litres) and the oil capacity 8 U.S. gallons (30 litres).

Dimensions.—Main rotor diameter 48 ft. 0 in. (14.63 m.), Tail rotor diameter 8 ft. 5 in. (2.56 m.), Length overall 57 ft. 0½ in. (17.39 m.), Length with rotor blades removed 44 ft. 11½ in. (13.69 m.), Main rotor disc area 1,810 sq. ft. (168 sq. m.).

Weights and Loadings.—Weight empty 3,650 lbs. (1,656 kg.), Disposable load 1,250 lbs. (567 kg.), Weight loaded 4,900 lbs. (2,223 kg.), Rotor disc loading 2.7 lbs./sq. ft. (13.17 kg./sq. m.), Power loading 10.9 lbs./h.p. (4.9 kg./h.p.).

Performance.—Cruising speed (65% power) 80 m.p.h. (129 km.h.), Hovering ceiling 3,500 ft. (1,065 m.), Service ceiling 13,000 ft. (3,960 m.), Climb at sea level 1,200 ft./min. (366 m./min.).

THE SIKORSKY VS-316A.

U.S. Army Air Forces designation: R-4B.
U.S. Navy designation: HNS-1.
British name: Hoverfly I.

Type.—Two-seat Training Helicopter.

Rotors.—One three-blade main rotor 38 ft. (11.6 m.) diameter and one three-blade vertical controllable-pitch anti-torque and steering rotor 7 ft. 8 in. (2.30 m.) diameter carried on an outrigger extension of the fuselage, both rotors driven through transmission shafts and gear boxes by a single engine. Transmission for the main rotor is through a single plate clutch and double reduction gear. Rotor brake, free-wheel and emergency rotor release to permit auto-rotation in case of transmission seizure provided. Fixed rotor head with cyclic pitch control mounted on a welded steel-tube pylon forming integral part of fuselage structure. Main rotor disc area 1,134 sq. ft. (105.3 sq. m.).

Fuselage.—Welded steel tube structure covered with detachable metal panels forward and fabric aft.

The Sikorsky R-4B Two-seat Training Helicopter (185 h.p. Warner R-550-1 engine).

***SIKORSKY**—continued.*

The Sikorsky R-5A Two-seat Observation Helicopter (450 h.p. Pratt & Whitney R-985-AN1 engine).

LANDING GEAR.—Three wheel type. Two main wheels forward have vertical shock-absorber struts supported by steel-tube pyramids built into the sides of the fuselage. Track 10 ft. (3.05 m.). Tail-wheel mounted under rear fuselage. Wheel gear may be replaced by two low-pressure rubberised floats.

POWER PLANT.—One 185 h.p. Warner R-550-1 seven-cylinder radial fan-cooled engine mounted within fuselage aft of cockpit. Cooling air drawn through louvres in forward face of the rotor pylon casing blown by large-diameter engine-driven fan on to engine and exhausted through openings in underside of fuselage. Cylindrical fuel and oil tanks in fuselage aft of transmission compartment.

ACCOMMODATION.—Enclosed cabin in nose of fuselage seating two side-by-side with dual controls. Two central control columns operate cyclical pitch for forward, sideways and reverse movements. Second lever between seats controls blade pitch in unison for vertical movement. Rudder pedals operate on tail rotor for directional control. Radio equipment originally fitted has been removed. One litter may be carried externally.

DIMENSIONS.—Rotor diameter 38 ft. (11.6 m.), Overall length (including rotor) 48 ft. 1 in. (14.65 m.), Overall height 12 ft. 5 in. (3.78 m.),

WEIGHTS.—Weight empty 2,011 lbs. (913 kg.), Weight loaded 2,540 lbs. (1,153 kg.).

PERFORMANCE.—Maximum speed 75 m.p.h. (120 km.h.), Climb to 8,000 ft. (2,440 m.) 45 min., Service ceiling 8,000 ft. (2,440 m.).

THE SIKORSKY VS-372.

U.S. Army Air Forces designation : R-5A.

U.S. Navy designation: HO2S-1.

TYPE.—Two-seat Observation Helicopter.

ROTORS.—One three-blade main rotor 48 ft. (14.6 m.) diameter and one three-blade vertical controllable-pitch anti-torque rotor 7 ft. (2.1 m.) diameter at rear end of fuselage. Rotor transmission same as for R-4B. Main rotor disc area 1,810 sq. ft. (168 sq. m.).

FUSELAGE.—In three sections. Centre-section enclosing power-unit and rotor pylon of welded steel-tube and cowled with plastic-impregnated moulded plywood. The nose section enclosing the crew compartment has as a foundation an aluminium monocoque floor on which is built an aluminium-alloy channel superstructure panelled with Plexiglas windows. The tail section is a light wooden monocoque.

LANDING GEAR.—Conventional three-wheel type with the two main wheels sprung at the extremities of two cantilever side members. Tail wheel on steel tube pylon aft of the engine housing at the root of the rear fuselage. Track 12 ft. (3.6 m.).

POWER PLANT.—One 450 h.p. Pratt & Whitney R-985-AN-5 radial fan-cooled engine modified for installation within the fuselage with crankshaft vertical. Main rotor drive through conventional reduction gear, with take-off drive in main gear box for auxiliary tail rotor drive. Tail rotor drive shaft runs externally along top of rear fuselage. Cooling air for engine drawn in through aperture in front of face of rotor pylon housing and exhausted through openings in underside of fuselage. Fuel and oil tanks in fuselage aft of transmission compartment.

ACCOMMODATION.—Enclosed compartment in nose seats two in tandem with dual controls. Observer in front. Provision for cameras, radio and other auxiliary equipment. Four litters, two on each side of the fuselage, may be carried.

DIMENSIONS.—Rotor diameter 48 ft. (14.6 m.), Overall length 57 ft. 1 in. (17.4 m.).

WEIGHT LOADED.—5,000 lbs. (2,272 kg.).

PERFORMANCE.—Maximum speed 90 m.p.h. (144 km.h.).

THE SIKORSKY R-6A.

U.S. Navy designation: HOS-1.

TYPE.—Two-seat Observation Helicopter.

ROTORS.—Rotor system and transmission similar to R-4B. Main rotor disc area 1,134 sq. ft. (105.3 sq. m.).

FUSELAGE.—All-metal framework. The cabin section has an aluminium floor and is covered with moulded plastic-impregnated glass fibre cloth and Plexiglas transparent moulded nose and side and roof windows. Paper-based moulded plastic cowling encloses the engine compartment and rotor pylon. The rear fuselage carrying the tail rotor is a light metal monocoque.

LANDING GEAR.—Conventional landing-gear with the main wheels on cantilever oleo struts, a tail-wheel on a steel tube pyramid midway between nose and tail and a small emergency nose wheel. Hydraulic wheel brakes on main wheels. Track 9 ft. (2.7 m.). Landing-gear may be replaced by flotation gear.

POWER PLANT.—One 245 h.p. Franklin O-405-9 six-cylinder horizontally-opposed fan-cooled engine mounted with crankshaft vertical within the fuselage aft of the cabin. Planetary gear transmission to rotor. Fuel and oil tanks in fuselage aft of transmission compartment.

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Equipment includes high-frequency radio communication set. An evacuation litter may be installed on each side of fuselage.

DIMENSIONS.—Rotor diameter 38 ft. (11.6 m.), Overall length 47 ft. 11 in. (14.6 m.).

WEIGHT LOADED.—2,600 lbs. (1,180 kg.).

PERFORMANCE.—Maximum speed 100 m.p.h. (161 km.h.). Climb to 5,900 ft. (1,800 m.) 7 min., Service ceiling 10,000 ft. (3,050 m.), Maximum duration 5 hours.

The Sikorsky R-6A Two-seat Observation Helicopter (245 h.p. Franklin O-405-9 engine).

SPARTAN.

THE SPARTAN AIRCRAFT COMPANY.

HEAD OFFICE AND WORKS : TULSA, OKLAHOMA.

President : J. Paul Getty.
Vice-President, Captain M. W. Balfour.
Chief Engineer : W. Fred Stewart.
Secretary and Treasurer : Lyman S. Miller.

The Spartan Aircraft Company, which was incorporated in 1928, originally devoted itself to the design of commercial aircraft, of which the Spartan Executive four/five-seat low-wing cantilever monoplane with retractable landing gear and the 450 h.p. Pratt & Whitney Wasp-Junior engine, was the last type produced before the United States entered the War. This model was originally designed and built in 1935. Several examples of the Executive taken over by the U.S. Army Air Forces for light personnel transport use after the outbreak of war were given the designation UC-71.

In 1940 the Company produced its first military design, the NS-1 primary training biplane. This model when ordered by the U.S. Navy was designated NP-1.

During the war years the company was engaged solely in the manufacture of aircraft parts and assemblies under sub-contracts from other manufacturers. The factory was greatly enlarged and now has a floor area of 350,000 sq. ft.

The Spartan Company has completed the prototype of a new Model 12 Executive, an all-metal five-seat cabin monoplane with retractable tricycle landing-gear. Like the pre-war Executive, the new Model 12 will be fitted with a 450 h.p. Pratt & Whitney Wasp Junior engine.

Other post-war products of this Company include aircraft radios, all-metal caravan trailers, food-freezing cabinets and floor furnaces.

THE SPARTAN EXECUTIVE.

TYPE.—Five-seat Cabin monoplane.

WINGS.—Cantilever low-wing monoplane, with aluminium spars and ribs and sheet metal skin. Detachable tips. All-metal ailerons and electrically-operated trailing-edge flaps. Wing area 245 sq. ft. (22.75 sq. m.).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with metal covering over all surfaces. Trim-tabs in rudder and elevators. Tailplane span 13 ft. 8 in. (4.16 m.).

LANDING GEAR.—Retractable tricycle type. Each main wheel (Goodyear or Hayes 7.50 × 10) carried on oleo shock-absorber leg retracts inwards into wing and is enclosed by fairing plates. Electric operation. Track 7 ft. 10 in. (2.39 m.). Goodyear or Hayes hydraulically-operated brakes. Non-steerable nose-wheel.

POWER PLANT.—One Pratt & Whitney Wasp-Junior B-5 nine-cylinder radial air-cooled engine developing 450 h.p. at 2,300 r.p.m. and driving Hamilton Standard two-blade constant-speed metal airscrew. Fuel capacity 130 U.S. gallons (492 litres).

ACCOMMODATION.—Enclosed cabin seating pilot (on port) and one passenger side-by-side with dual controls, and full-width seat at rear for three passengers side-by-side. Access door 2 ft. 6 in. (0.86 m.) wide on port side. Baggage compartment of 38 cub. ft. (1.07 cub. m.) capacity aft of cabin ; allowance 150 lbs. (68 kg.).

DIMENSIONS.—Span 39 ft. (11.88 m.), Length 27 ft. 5 in. (8.35 m.), Height 9 ft. (2.74 m.).

WEIGHTS AND LOADINGS.—Weight empty 2,740 lbs. (1,243 kg.), Disposable load 1,910 lbs. (866 kg.), Weight loaded 4,650 lbs. (2,109 kg.), Wing loading 19.18 lbs./sq. ft. (93.6 kg./sq. m.), Power loading 10.44 lbs./h.p. (4.72 kg./h.p.).

PERFORMANCE.—Maximum speed 215 m.p.h. (346 km.h.) at sea level, Cruising speed 203 m.p.h. (327 km.h.) at sea level, Landing speed 58.5 m.p.h. (94 km.h.), Initial rate of climb 1,340 ft./min. (408 m./min.), Service ceiling 24,080 ft. (7,340 m.), Cruising range 1,067 miles (1,717 km.), Take-off run 261 yds. (239 m.), Landing run 227 yds (207 m.),

STINSON.

THE STINSON DIVISION OF THE CONSOLIDATED VULTEE AIRCRAFT CORPORATION.

HEAD OFFICE : SAN DIEGO, CAL.
WORKS : WAYNE, MICH.
Manager of the Stinson Division : Ernest Wenigmann.
General Sales Manager : L. H. Cooper.

In the Summer of 1940 the Stinson Aircraft Division of the Aviation Manufacturing Corpn. was taken over by Vultee and became the Stinson Aircraft Division of Vultee Aircraft, Inc. Early in 1943 the Vultee Company merged with the Consolidated Aircraft Corpn. to form the Consolidated Vultee Aircraft Corpn.

The Stinson Division of Consolidated Vultee is still located at Wayne but the original Stinson factory has been greatly extended and during the war was engaged solely in the manufacture of military aircraft and parts.

The principal wartime products of the Division were the L-5 Sentinel and the AT-19 Reliant, both directly descended from pre-war Stinson civil aeroplanes. The predecessor of the Sentinel, the Stinson Voyager, has been revived for post-war use and details are given hereafter of the new Stinson Voyager 150 which is now in production.

THE STINSON MODEL 108 VOYAGER 150.

Production of the original three-seat Stinson Voyager was discontinued by the Stinson Division when America entered the War, but preparations were made in 1944-45 to resume production as soon as possible after the war.

The prototype of the post-war four-seat Voyager, fitted with a 125 h.p. Lycoming engine, was test flown in December, 1944. The standard production Voyager is fitted with a 150 h.p. Franklin engine and is known as the Voyager 150.

TYPE.—Four-seat Cabin monoplane.

WINGS.—Strut-braced high-wing monoplane. Aerofoil section NACA 4412. All-metal two-spar constant-chord structure attached to top of fuselage and braced to bottom of fuselage by V-struts on each side. Fabric covering. Dihedral 2½ degrees ; chord 4 ft. 9 in. (1.45 m.) ; gross wing area 155 sq. ft. (14.39 sq. m.). Metal ailerons with fabric covering. Aileron span 7 ft. 6 in. (2.29 m.) ; aileron area (total) 18.02 sq. ft. (1.67 sq. m.). All-metal slotted flaps between ailerons and fuselage. Flap span 6 ft. 8 in. (2.03 m.) ; flap area (total) 12.22 sq. ft. (1.13 sq. m.). Fixed leading-edge slots ahead of ailerons. Slot span 3 ft. 2 in. (0.96 m.).

FUSELAGE.—Welded steel-tube structure. Vertical frames, longitudinal stringers and fabric covering.

TAIL UNIT.—Cantilever monoplane type. Metal structure with metal covering over all surfaces. Horn-balanced rudder and elevators. Trim-tab in port elevator. Tailplane incidence, 3 degrees ; tailplane and elevator span 11 ft. 2 in. (3.40 m.) ; tailplane and elevator chord (maximum) 3 ft. 9 in. (1.14 m.) ; tailplane area 14.66 sq. ft. (1.36 sq. m.) ; rudder area 5.93 sq. ft. (1.81 sq. m.) ; fin area 6.6 sq. ft. (0.61 sq. m.) ; elevator area (total) 17.24 sq. ft. (1.60 sq. m.).

LANDING GEAR.—Fixed two-wheel type. Each main wheel carried on single cantilever hydraulic shock-absorber strut. Goodyear wheels with 7.00-6 tyres. Metal spats. Hydraulic single-disc brakes. Track 7 ft. 1 in. (2.16 m.). Steerable full-swivelling tail-wheel. Wheel base (tail down) 18 ft. 7 in. (5.66 m.).

POWER PLANT.—One Franklin 6A4-150-B3 six-cylinder horizontally-opposed direct-drive air-cooled engine rated at 150 h.p. at 2,600 r.p.m. and driving Sensenich two-blade fixed-pitch wooden airscrew, 6 ft. 4 in. (1.93 m.) diameter. Ground clearance (tail-up) 9.14 ins. (23 c/m.). Four-piece cowling. Marvel-Schebler MA-3SPA carburettor. Delco-Remy starter and generator. Fuel capacity 40 U.S. gallons (151 litres) ; oil capacity 2 U.S. gallons (7.6 litres.)

The Stinson Voyager 150 Four-seat Cabin Monoplane (150 h.p. Franklin 6A4-150-B3 engine).

***STINSON**—continued.*

The Stinson Voyager 150 Four-seat Cabin Monoplane (Franklin 6A4-150-B3 engine).

Accommodation.—Enclosed cabin seating four in two pairs. Dual controls. Access door on each side. Fiberglas sound-proofing.

Dimensions.—Span 33 ft. 11 in. (10.33 m.), Length 24 ft. 6 in. (7.46 m.), Height (tail down, over cabin) 6 ft. 10 in. (2.08 m.).

Weights and Loadings.—Weight empty 1,206 lbs. (547 kg.). Useful load 944 lbs. (428 kg.), Weight loaded 2,150 lbs. (975 kg.), Wing loading 13.8 lbs./sq. ft. (67.38 kg./sq. m.), Power loading 14.33 lbs./h.p. (6.48 kg./h.p.).

Performance.—Maximum speed 133 m.p.h. (214 km.h.), Cruising speed 125 m.p.h. (201 km.h.), Landing speed 51 m.p.h. (82 km.h.), Climb at sea level 770 ft./min. (235 m./min.), Service ceiling 14,000 ft. (5,265 m.), Range 500 miles (805 km.), Take-off run at sea level 183 yds. (167 m.).

STRICKLAND.

STRICKLAND AIRCRAFT CORPORATION.

Head Office and Works: High Point, North Carolina.

President and General Manager: C. Kenneth Strickland.

Vice-President: H. Winton Strickland.

Chief Engineer: Bion S. Hutchins, Jr.

Secretary and Treasurer: O. H. Moore.

The Strickland Aircraft Corpn. has been engaged in the manufacture of aircraft parts and sub-assemblies under sub-contract to other aircraft manufacturers.

For post-war production it has designed a twin-engined mid-wing monoplane, the principal feature of which will be an engine installation in which the power-units will be buried within the wings and drive tractor airscrews. It will be offered in two models, one accommodating pilot and four or five passengers and the other from twelve to fifteen persons.

TAYLORCRAFT.

TAYLORCRAFT AVIATION CORPORATION.

Head Office and Works: Alliance, Ohio.

The Taylorcraft Aviation Corpn. was formed to take over the Taylorcraft Aviation Co., which was formed in 1936 by Mr. C. G. Taylor. Mr. Taylor had previously been President and Chief Engineer of the Taylor Aircraft Co., which produced the original Cub light cabin monoplane, the forerunner of the modern popular-priced American light aeroplane.

The Taylorcraft Aviation Corpn., began post-war production with the Model BC12D, which is basically the same as the Model B-12 which was marketed before the war. Several minor changes were introduced as the result of production and wide-spread use of the L-2 Grasshopper in war service, including a strengthening of the fuselage structure and a simplified wing structure to permit of easier replacement of components away from the factory. In the first six months of 1946 2,800 BC12Ds were delivered. The maximum daily output reached fifty but shortage of engines held up final assembly.

The Taylorcraft Model 15 four-seat cabin monoplane was delayed by design changes and a fire at the Alliance plant which destroyed jigs, dies and fixtures prepared for the production of this aircraft. The Model 15, which already has its ATC certificate, was due to go into production early in 1947.

Late in 1946, the Taylorcraft Corporation got into financial difficulties and on the recommendation of a trustee placed in change of the company in November, the assets of the company were, by order of the Federal court, to be offered at public auction in March, 1947.

THE TAYLORCRAFT MODEL BC12D TWOSOME.

Type.—Two-seat light cabin monoplane.

Wings.—Strut-braced high-wing monoplane. Wings attached to top of fuselage and braced to lower longerons by steel-tube V-struts, which have vertical intermediate struts located at their centres. Wing structure consists of two multi-laminar wood spars, stamped aluminium-alloy ribs and fabric covering, secured by safety-clip wire-stitching. Each wing panel made in three sections, nose, centre and rear, which are assembled together before covering. Wing area 183.5 sq. ft. (17 sq. m.).

Fuselage.—Welded steel-tube structure with light fairing frames and longitudinal stringers covered with fabric.

Tail Unit.—Wire-braced monoplane type. Welded steel-tube framework, covered with fabric. Tailplane span 10 ft. (3.05 m.).

Landing Gear.—Split type. Consists of two faired side Vees hinged to the lower fuselage longerons, with bent half-axles sprung on the centre-line of the underside of the fuselage by rubber shock-absorber cord. Welded steel-tube swivelling tail-wheel. Track 6 ft. (1.83 m.).

Power Plant.—One 65 h.p. Continental A65 four-cylinder horizontally opposed air-cooled engine. Sensenich two-blade fixed-pitch wooden airscrew. Fuel capacity 12 U.S. gallons (45 litres). Auxiliary tank (6 U.S. gallons = 23 litres capacity) may be installed.

Accommodation.—Enclosed cabin, seating two side-by-side, with dual control. Interchangeable wheel or stick type controls. Door on each side of cabin. Baggage compartment of 4.5 cub. ft. (0.13 cub. m.).

Dimensions.—Span 36 ft. (11 m.), Length 22 ft. (6.7 m.), Height 6 ft. 8 in. (2.1 m.).

Weights and Loadings.—Weight empty 670 lbs. (287 kg.), Disposable load 480 lbs. (235 kg.), Weight loaded 1,150 lbs. (522 kg.), Wing loading 6.88 lbs./sq. ft. (33.6 kg./sq. m.), Power loading 22 lbs./h.p. (10 kg./h.p.).

Performance.—Maximum speed 110 m.p.h. (176 km.h.), Cruising speed 95 m.p.h. (142 km.h.), Landing speed 38 m.p.h. (61 km.h.), Initial rate of climb 600 ft./min. (183 m./min.), Absolute ceiling 17,000 ft. (3,660 m.), Maximum range 500 miles (800 km.), Fuel consumption 4.4 U.S. gallons/hr. (16.6 litres/hr.).

THE TAYLORCRAFT ACE.

The Ace is a two-seat cabin monoplane generally similar to the Twosome, and is powered by the same type of engine.

Performance.—Maximum speed 117 m.p.h. (188 km.h.), Cruising speed 100 m.p.h. (161 km.h.), Landing speed 38 m.p.h. (61 km.h.), Initial rate of climb 750 ft./min. (229 m./min.), Service ceiling 15,000 ft. (4,570 m.), Cruising range 270 miles (435 km.), Take-off run 117 yds. (107 m.), Landing run 100 yds. (91 m.).

THE TAYLORCRAFT MODEL 15 TOURIST.

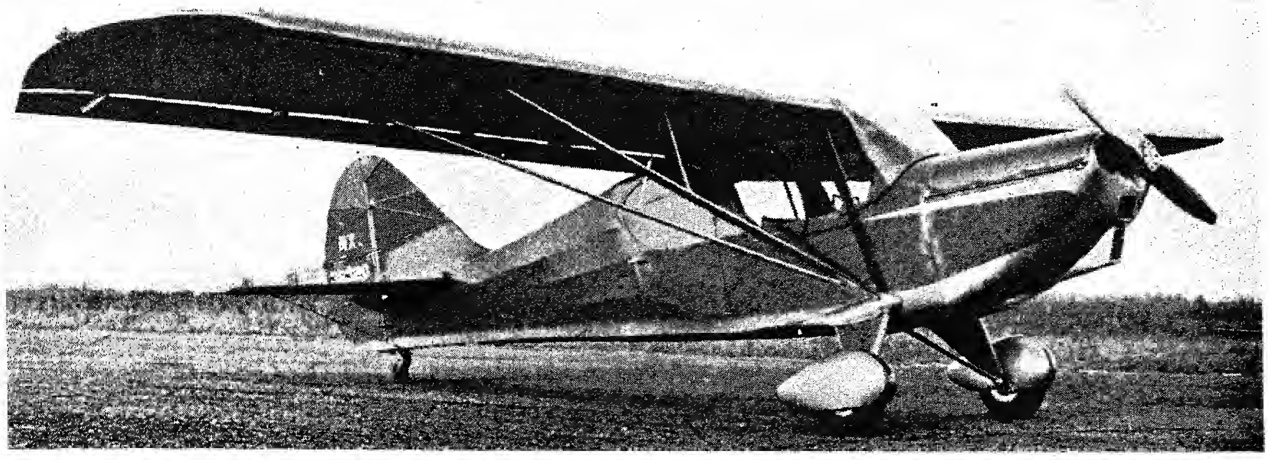
Type.—Four-seat Cabin monoplane.

Wings.—Braced monoplane type. Wings attached to top of fuselage and braced to lower longerons by steel-tube V-struts on each side. Wooden spars, metal ribs and leading-edge and fabric-covering. All-metal ailerons and manually-operated slotted trailing-edge flaps. Built-in slots. Wing area (approximate) 207 sq. ft. (19.23 sq. m.).

Fuselage.—Steel-tube structure with fabric covering.

Tail Unit.—Wire-braced monoplane type. Metal structure with fabric covering. Trim-tab in each elevator. Tailplane span 11 ft. 9 in. (3.58 m.).

Landing Gear.—Fixed two-wheel divided type. Main wheels (Goodyear 7.00 × 6) each carried on faired oleo/rubber suspension shock-absorber leg with axle meeting fuselage centre-line. Track 6 ft. 3 in. (1.90 m.). Hydraulically-operated brakes. Goodyear



The Taylorcraft Model 15 Four-seat Cabin Monoplane (150 h.p. Franklin engine).

solid bonded rubber tail-wheel on full-swivelling spring-loaded strut. Twin float or ski undercarriage optional.

Power Plant.—One Franklin 6A4-150-B3 six-cylinder horizontally-opposed air-cooled engine developing 150 h.p. at 2,600 r.p.m. and driving Sensenich two-blade wooden airscrew. Fuel capacity 40 U.S. gallons (151 litres).

Accommodation.—Enclosed cabin seating four in two pairs, with dual controls in front. Two metal access doors on each side. Baggage compartment of 6 cub. ft. (0.17 cub. m.) capacity aft of rear seats, allowance 100 lbs. (45 kg.).

Dimensions.—Span 36 ft. 4¾ in. (11.09 m.), Length 24 ft. 0⅝ in. (7.32 m.), Height 7 ft. 1$\frac{11}{16}$ in. (2.20 m.).

Weights and Loadings.—Weight empty 1,650 lbs. (748 kg.), Weight loaded 2,450 lbs. (1,111 kg.), Wing loading 11.8 lbs./sq. ft. (57.6 kg./sq. m.), Power loading 16.4 lbs./h.p. (7.43 kg./h.p.).

Performance.—Maximum speed 120 m.p.h. (193 km.h.), Cruising speed 110 m.p.h. (177 km.h.), Landing speed (with flaps) 45 m.p.h. (72 km.h.), Stalling speed 42 m.p.h. (68 km.h.), Initial rate of climb 500 ft./min. (152 m./min.), Service ceiling 12,000 ft. (3,660 m.), Cruising range 575 miles (925 km.), Take-off run 250 yds. (228 m.), Landing run 125 yds. (114 m.), Fuel consumption 8 U.S. gallons/hr. (30.28 litres/hr.).

THORP.

THORP AIRCRAFT COMPANY.

Head Office and Works: 8,000, Woodley Avenue, Van Nuys, California.

The Thorp Aircraft Company has been formed by Mr. John K. Thorp to develop a light two-seat low-cost aircraft which he designed while employed by the Lockheed Aircraft Corpn. His original design known as the "Little Dipper" was built by the Lockheed company while it was investigating the possibility of entering the personal plane market. When Lockheed abandoned this project Mr. Thorp left to form his own company.

The prototype of the new Thorp Sky Scooter flew at the Metropolitan Airport, Van Nuys, in August, 1946, and his company has established itself in that area to continue flight tests and to undertake commercial production.

UNITED AIRCRAFT.

THE UNITED AIRCRAFT CORPORATION.

Head Office: 400, South Main Street, East Hartford 8, Conn.

Chairman of the Board: F. B. Rentschler.

Vice-Chairmen: Eugene E. Wilson and Raycroft Walsh.

President: H. Mansfield Horner.

Vice-President: Leonard S. Hobbs (Engineering), S. A. Stewart and C. J. McCarthy.

Controller: W. R. Robbins.

Secretary: Charles H. Chatfield.

Treasurer: Carroll L. Gault.

The United Aircraft Corpn., founded in 1934, includes four divisions engaged in the manufacture of aircraft, engines and airscrews. These are the Chance Vought Aircraft Division (Aircraft), the Sikorsky Aircraft Division (Helicopters), the Pratt & Whitney Aircraft Division (Engines), and the Hamilton Standard Propeller Division (Airscrews).

For descriptions of the aircraft products of the United Aircraft Corpn., see under "Chance Vought" and "Sikorsky" respectively. For details of the products of the Pratt & Whitney Aircraft Division see under "Pratt & Whitney" in the Engine Section.

UNITED HELICOPTERS.

UNITED HELICOPTERS, INC.

Head Office: 625, El Camino Real, Palo Alto, California.

President: Stanley Hiller, Jr.

Secretary and Treasurer: R. L. Chambers.

United Helicopters, Inc. supersedes the Aircraft Division of Hiller Industries which was established in 1942 for the development and production of co-axial rotor helicopters. The first Hiller-copter was a 125 h.p. single-seat aircraft incorporating entirely new principles of control and operation and was demonstrated at San Francisco in August, 1944. A photograph and brief particulars of this aircraft appeared in the 1945-46 edition of "All the World's Aircraft." A second experimental aircraft with two seats and a 235 h.p. engine was developed for the U.S. Navy.

The Company is now building the prototype of a two-seat helicopter known as the Commuter, a specification of which follows. Larger types of helicopter are projected.

THE UNITED HELICOPTERS MODEL C-4 COMMUTER.

Type.—Two-seat Helicopter.

Rotors.—Two two-blade co-axial rotors, diameter 32 ft. (9.75 m.) mounted on vertical shaft above fuselage. Blades have steel-tube spars and metal covering. Rotor speed 260 r.p.m. Rotor disc area 804 sq. ft. (74.8 sq. m.). No anti-torque tail-rotor. No details of transmission available.

Fuselage.—Welded steel-tube structure with metal covering aft of cabin.

Landing Gear.—Fixed type consisting of two main wheels carried on faired cantilever legs, and similarly-mounted rear wheel. Track 8 ft. (2.44 m.).

Power Plant.—One 150 h.p. Lycoming four-cylinder horizontally-opposed air-cooled engine mounted in fuselage. Fuel capacity 20 U.S. gallons (76 litres).

Accommodation.—Enclosed cabin in nose seating two side-by-side. The entire cabin from floor level upwards and to the backs of the seats is formed of moulded transparent material.

Rotor Diameter.—32 ft. (9.75 m.).

Weights and Loadings (Designed).—Weight empty 1,080 lbs. (490 kg.), Useful load 520 lbs. (236 kg.), Weight loaded 1,600 lbs. (72 kg.), Rotor disc loading 1.99 lbs./sq. ft. (9.70 kg./sq. m.), Power loading 10.7 lbs./h.p. (5.24 kg./h.p.).

Performance (Estimated).—Maximum speed 120 m.p.h. (193 km.h.), Cruising speed 100 m.p.h. (161 km.h.), Climb at sea level 1,650 ft. min. (503 m./min.), Service ceiling 10,000 ft. (3,050 m.), Normal range 200 miles (322 km.).

VOLMER JENSEN.

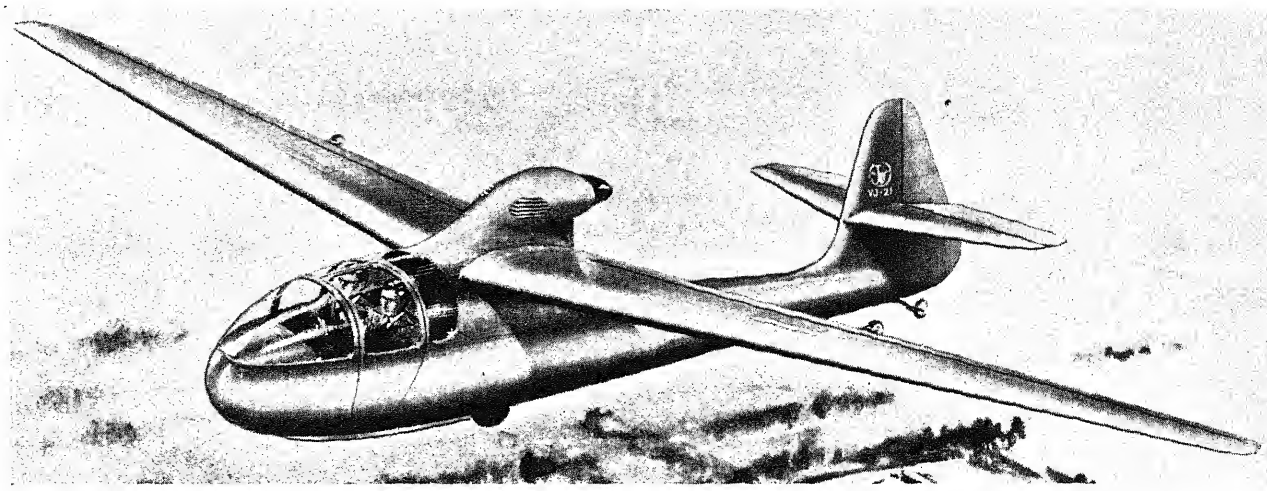
VOLMER JENSEN.

Head Office and Works: Glendale 1, California.

The VJ-21 Jaybird light monoplane has been designed by Mr. Volmer S. Jensen, a well-known pilot and designer of sailplanes and responsibility for its production was originally accepted by the Jarvis Manufacturing Co. This company has, however, withdrawn from aircraft manufacture and has sold the manufacturing rights back to Mr. Volmer Jensen.

Outwardly this aircraft resembles a conventional sailplane, but is powered by a 65 h.p. pusher engine mounted above the wing. The VJ-21 has undergone preliminary tests but the designer is now considering the advisability of enlarging the cabin to seat three and substituting a tricycle landing-gear for the single wheel used on the prototype, which is described hereafter.

VOLMER JENSEN—*continued.*



A drawing of the Volmer Jensen VJ-21 Two-seat Light Pusher Monoplane (65 h.p. Lycoming O-145-B3 engine).

THE VOLMER JENSEN VJ-21 JAYBIRD.

TYPE.—Two-seat light monoplane.

WINGS.—Cantilever high-wing monoplane. Aerofoil section (root) modified NACA 2418; (tip) modified NACA 4412. Aspect ratio 13. All-metal structure with metal covering. Root chord 5 ft. 0 in. (1.52 m.), tip chord 2 ft. 0 in. (0.61 m.). Long span ailerons and plain-hinge flaps. Spoilers above wing ahead of ailerons. Wing area 158 ft. (14.67 sq. m.).

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—Cantilever monoplane type of all-metal construction. Tailplane mounted half-way up fin.

LANDING GEAR.—Single main landing-wheel attached directly to main fuselage bulkhead and protruding 8 in. (20.3 c/m.) below fuselage. No shock-absorption medium. Steel nose skid attached to bottom of fuselage ahead of wheel. Main wheel fitted with brake. Small manually-operated retractable wing-wheels on sprung steel-tube struts positioned half-way between fuselage and wing-tips swing down to support wings while taxying. Steerable tail-wheel.

POWER PLANT.—One 75 h.p. Lycoming 0-145-B3 four-cylinder horizontally-opposed engine mounted as pusher unit above wing and driving a two-blade propeller.

ACCOMMODATION.—Enclosed cabin 42 in. (104 c/m.) wide seating two side-by-side.

DIMENSIONS.—Span 45 ft. 0 in. (13.71 m.), Length 24 ft. 0 in. (7.32 m.).

WEIGHTS AND LOADINGS.—Weight empty 850 lbs. (385 kg.). Weight loaded 1,350 lbs. (612 kg.). Wing loading 8.6 lbs./sq. ft. (42 kg./sq. m.), Power loading 20.7 lbs./h.p. (9.38 kg./h.p.).

PERFORMANCE (Estimated).—Maximum speed 135 m.p.h. (214 km.h.), Cruising speed at 70% power 110 m.p.h. (177 km.h.). Landing speed 40 m.p.h. (64 km.h.). Stalling speed 35 m.p.h. (56 km.h.), Rate of climb at sea level 700 ft./min. (213 m./min.), Service ceiling 16,000 ft. (4,875 m.), Cruising range 400 miles (644 km.), Take-off distance to 50 ft. (15 m.) 320 yds. (292 m.), Landing run 50 yds. (46 m.), Landing distance from 50 ft. (15 m.) 183 yds. (167 m.).

WACO.

THE WACO AIRCRAFT COMPANY.

HEAD OFFICE AND WORKS: TROY, OHIO.
Established: 1921.
President: Clayton J. Brukner.
Vice-President and General Manager: H. R. Perry.
Vice-President in charge of Engineering: A. Francis Arcier.
Secretary: Baird Broomhall.
Treasurer: R. E. Hoefflin.

The Waco Aircraft Co. is the oldest and, before America entered the War, was one of the largest producers of civil aircraft in the U.S.A.

From August, 1941 to August, 1945, the Company devoted its entire efforts to war contracts. Its most important contribution to the war programme was in the troop and cargo-carrying glider field. Four gliders were produced, the CG-3A troop training glider and the CG-4A, CG-13A and CG-15A troop and cargo-carrying gliders. The CG-4A was mass-produced by fifteen American manufacturers and over 20,400 were delivered. The CG-3A was never built in quantity. The CG-13A forty-two-seat troop and cargo-carrying glider of Waco design was built by the Northwestern Aeronautical Corpn. and by the Ford Motor Co.

The Company is at present engaged in developing a new aircraft for civilian use, known as the Aristocraft, a description of which follows.

THE WACO ARISTOCRAFT.

The Aristocraft is a new four-seat cabin monoplane the prototype of which was under construction at the time of writing. It is of unorthodox lay-out in having a pusher propeller situated between the twin rudders and driven through a shaft drive by a 215 h.p. Franklin engine mounted in the nose. This arrangement is designed to eliminate the slipstream forces from the fuselage, resulting in improved performance; to simplify access to the cabin and to reduce noise in the cabin. The Aristocraft employs a "two-control" system wherein the rudder and aileron controls are combined and there is no rudder-bar.

Deliveries of the Aristocraft were scheduled to begin in 1947.

TYPE.—Four-seat Pusher Monoplane.

WINGS.—Braced high-wing monoplane. All-metal constant-chord structure braced to fuselage by a single strut on each side. Full-span ailerons of all-metal construction.

FUSELAGE.—Steel-tube structure with fabric-covering.

TAIL UNIT.—All-metal structure consisting of cantilever tailplane, two-piece elevator and twin fins and rudders mounted as endplates.

LANDING GEAR.—Retractable tricycle type. Main wheels carried on Firestone rubber/air shock-absorber units which retract into streamlined fairings attached to sides of fuselage. Steerable nose-wheel retracts rearwards into fuselage.

A drawing of the Waco Aristocraft Four-seat Pusher Monoplane (215 h.p. Franklin engine).

WACO—*continued.*

POWER PLANT.—One Franklin six-cylinder horizontally-opposed air-cooled engine rated at 215 h.p. at 2,500 r.p.m. at sea level and with a cruising output of 161 h.p. at 2,300 r.p.m. at sea level. Engine mounted in nose on rubber-faced bearers and driving Hartzell two-blade reversible-pitch pusher propeller 7 ft. (2.13 m.) diameter in extreme stern by shaft drive. Bendix-Weiss constant-speed universal joints. Fuel capacity (80-Octane) 60 U.S. gallons (227 litres) in two rubber-cell wing tanks. Wet-sump oil system with capacity of 3¼ U.S. gallons (12.3 litres).

ACCOMMODATION.—Enclosed cabin under wing with accommodation for four in two pairs, the front pair with dual controls. Access door on each side. Rudder and aileron controls combined, eliminating rudder-bar. Luggage compartment of 16 cub. ft. (0.45 cub. m.) capacity aft of seats; access door under trailing-edge on port side of fuselage. Luggage allowance 120 lbs. (54 kg.).

DIMENSIONS.—Span 38 ft. 0 in. (11.58 m.), Length 25 ft. 0⅜ in. (7.63 m.), Height 7 ft. 8 in. (2.34 m.).

WEIGHTS AND LOADINGS.—No data available.

PERFORMANCE (Estimated).—Maximum speed 154 m.p.h. (248 km.h.), Cruising speed 152 m.p.h. (245 km.h.) at 5,000 ft. (1,525 m.), Cruising speed at sea level 135 m.p.h. (217 km.h.), Landing speed 65 m.p.h. (105 km.h.). Stalling speed 55 m.p.h. (88 km.h.), Maximum rate of climb at sea level 950 ft./min. (290 m./min.), Service ceiling 17,500 ft. (5,335 m.), Maximum range 657 miles (1,057 km.) at 5,000 ft. (1,525 m.), or 605 miles (974 km.) at sea level.

WEATHERLY-CAMPBELL.

THE WEATHERLY-CAMPBELL AIRCRAFT COMPANY.

HEAD OFFICE: HIGHLAND PARK AIRPORT, DALLAS, TEXAS.

The Weatherly-Campbell Aircraft Co. has developed the Colt four-seat cabin monoplane from designs sold to the company by Don Luscombe and Fred Knack, both formerly with the Luscombe Airplane Corpn. At the time of writing an Approved Type Certificate for this aircraft was pending, and the Company was negotiating for production facilities.

The Weatherly-Compbell Company is primarily a fixed-base operator but during the war it undertook the production sub-assemblies and components for a number of aircraft manufacturers, including Lockheed, North American, Consolidated-Vultee, etc.

THE WEATHERLY-CAMPBELL COLT.

TYPE.—Four-seat Cabin monoplane.

WINGS.—Braced high-wing monoplane. Wings have compound taper with the point of maximum chord and thickness at points of attachment of wing bracing struts. Single steel-tube bracing strut on each side. Single metal spar and ribs, and sheet metal covering. All-metal ailerons and mechanically-operated trailing-edge flaps. Dihedral 1 degree. Wing area 132 sq. ft. (12.25 sq. m.).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with balanced control surfaces. Trim-tab in port elevator.

LANDING GEAR.—Fixed two-wheel type with faired legs and wheel spats. Track 7 ft. 1 in. (2.16 m.).

POWER PLANT.—One Lycoming O-435-A six-cylinder horizontally-opposed air-cooled engine developing 190 h.p. at 2,550 r.p.m. and driving two-blade fixed-pitch wooden airscrew. Fuel capacity 60 U.S. gallons (227 litres).

ACCOMMODATION.—Enclosed cabin with accommodation for four; two separate seats in front with throw-over dual controls, and full-width seat aft. Access door on each side. Hinged backs of front seats give access to back seats. Baggage compartment aft of rear seats with allowance of 120 lbs. (54 kg.).

DIMENSIONS.—Span 36 ft. 3 7/16 in. (11.01 m.), Length 23 ft. 10½ in. (7.28 m.), Height 7 ft. 1 in. (2.16 m.).

WEIGHTS AND LOADINGS.—Weight empty 965 lbs. (438 kg.), Disposable load 685 lbs. (310 kg.), Weight loaded 1,650 lbs. (748 kg.), Wing loading 12.5 lbs./sq. ft. (61 kg./sq. m.), Power loading 11 lbs./h.p. (4.98 kg./h.p.).

PERFORMANCE.—Maximum speed 160 m.p.h. (251 km.h.) at 8,000 ft. (2,440 m.), Cruising speed 140 m.p.h. (225 km.h.) at 8,000 ft. (2,440 m.), Landing speed 52 m.p.h. (84 km.h.), Initial rate of climb 1,000 ft./min. (305 m./min.), Cruising range 750 miles (1,207 km.), Fuel consumption 11.8 U.S. gallons/hr. (44.6 litres/hr.).

ALL THE WORLD'S AERO-ENGINES

(CORRECTED TO DECEMBER 31st, 1946)

ARRANGED IN ALPHABETICAL ORDER OF NATIONALITY

THE BRITISH EMPIRE

GREAT BRITAIN

GAS TURBINE ENGINES

ARMTRONG SIDDELEY.

ARMSTRONG SIDDELEY MOTORS LIMITED.

Head Office and Works: Coventry

Directors: See p. 14d.

Chief Engineer (Gas-turbines): W. F. Saxton.

Prior to their entry into the gas turbine field Armstrong Siddeley Motors had very many years experience of the manufacture of automobile and aircraft engines. They also did some of the early experimental work on axial-flow compressors and blade forms, as well as manufacturing the R.A.F. research contra-flow unit in 1939 to the designs of Dr. Griffiths.

Early in 1942 the Company first seriously considered the development of gas-turbine engines, and the design of the A.S.X. engine was subsequently prepared. This first conception was that of a jet engine of high efficiency which would give a sea level static thrust of 2,500 lbs. (1,134 kg.) with a specific consumption of less than unity. In order to achieve this, the engine was designed to embody an axial-flow compressor having a compression ratio of 5 : 1, and this necessitated a two-stage turbine. The prototype unit was produced in 1943, having taken only nine months for design and manufacture.

During the development of the A.S.X. engine, design studies were made of alternative means for increasing the thrust with a view to applying the turbine engine to moderate speed aircraft and the decision was taken to develop an airscrew gas-turbine engine based on the A.S.X.

This conversion entailed (1) the provision of a suitable reduction gear, and (2) the re-designing of the turbine to give the heat-drop required to provide the necessary shaft power. In other respects the engine remained substantially unaltered and the designers were therefore able to take advantage of the development experience gained on the A.S.X. engine.

The resulting engine, named the Python, first ran in March, 1945, and passed its acceptance test during the following month. Since then some hundreds of hours of development running have been carried out and the designed power of 3,670 S.H.P. + 1,150 lbs. (522 kg.) jet thrust (sea level static) has been attained. Further development flying trials are being made with two Pythons substituted for the outboard Merlins of an Avro Lancaster.

The Mamba is a lower-powered version of the Python, driving a single airscrew.

Development has continued on the A.S.X. engine and well over a thousand hours have been run on the test-bed. Additionally flight trials in the Lancaster universal flying test-bed have been made up to an altitude of 35,000 ft. (10,670 m.) with very satisfactory results, and these tests continue.

THE ARMSTRONG SIDDELEY A.S.X.

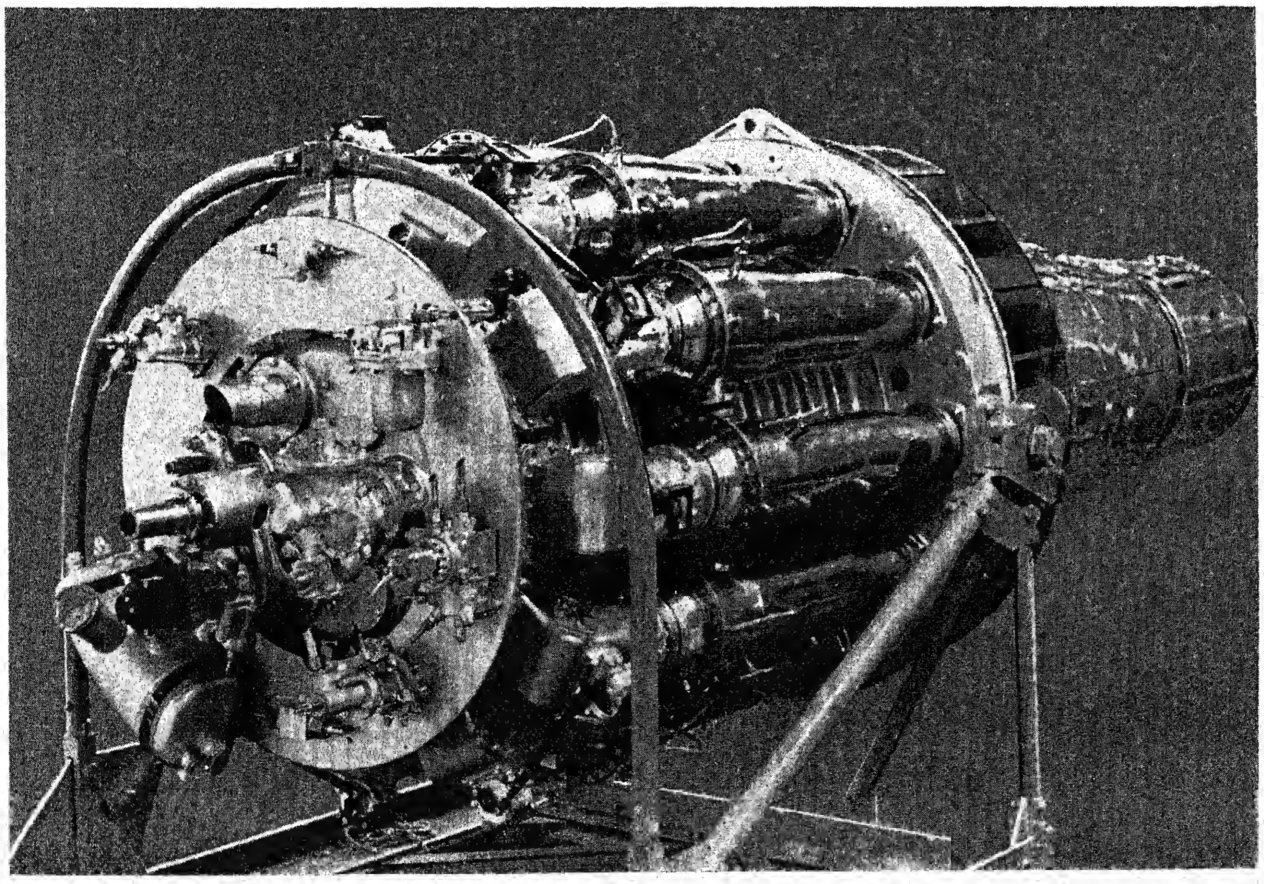
The A.S.X. engine consists in its essentials of a fourteen-stage air compressor of the axial-flow type, eleven combustion chambers, a two-stage turbine and the exhaust cone and propelling nozzle. The eleven combustion chambers are grouped around the compressor housing.

Air is taken in through eleven radially-disposed ducts situated between the combustion chambers and moves forward through the compressor where it is compressed in fourteen stages, the pressure in the final stage being raised to about five atmospheres. It is then displaced radially outwards by means of rings of guide vanes, divided into eleven flows and deflected backwards through eleven elbows into the combustion chambers, through which it flows into a manifold. Here the eleven air streams pass between the intake passages and are reformed into an annulus at the entry to the turbine. The gases then flow through the two-stage turbine into the exhaust cone and through the propelling nozzle to the atmosphere.

The main rotating drum of the A.S.X. compressor consists of two forged aluminium-alloy (R.R.56) sections bolted together on the inside, the division being between the high and low-pressure stages. Of the fourteen stages, five are low and nine are high-pressure. The outer casing, a light alloy casting, is split horizontally and carries the fixed or stator blades.

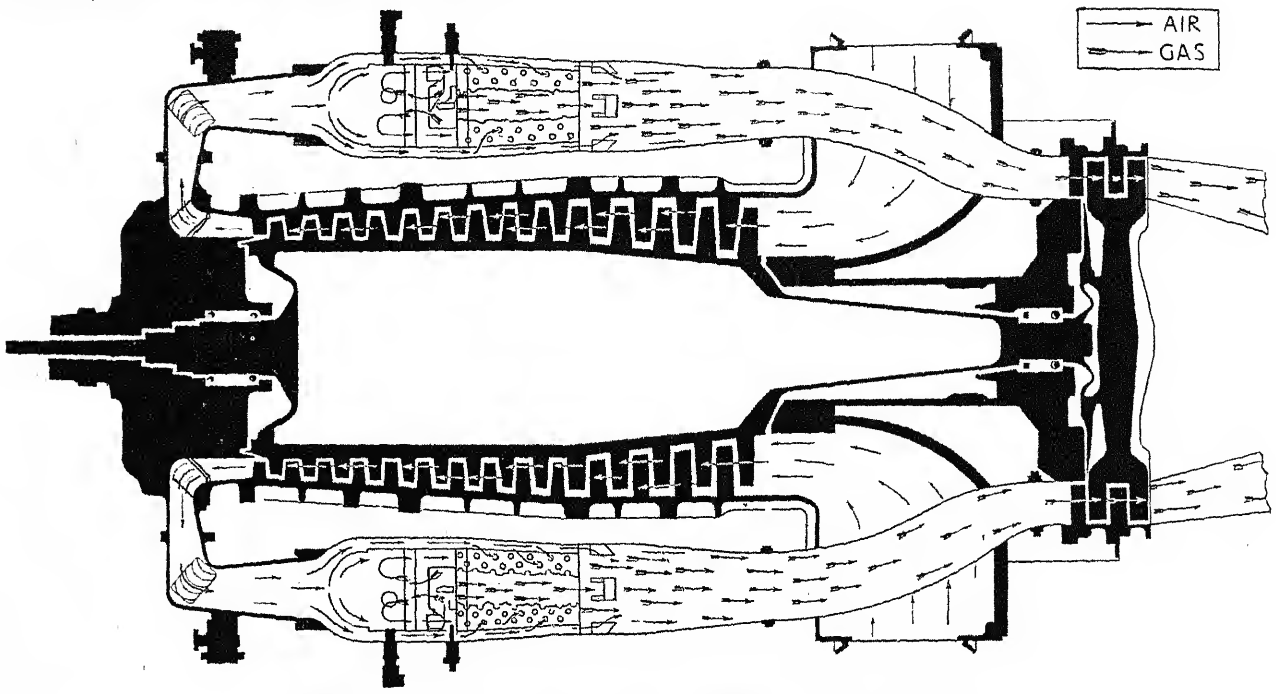
The main drives to and from the compressor drum are *via* front and rear main extension shafts, both of steel and bolted to the drum. At the rear end the drive from the turbine is through a splined sleeve to the stub shaft, which is itself attached by a ring of studs to the turbine disc, the disc having no centre hole. This moving assembly is carried on four bearings, two angular-contact ball-races at the front and one ball and one roller bearing at the rear end. The front shaft provides the drive for the accessories and a means of starting the unit.

Arrangements are made to cool both sets of bearings by passing air under the inner and over the outer races. The air for the turbine bearings is fed by external pipes from the fifth



The Armstrong Siddeley A.S.X. Axial-flow gas turbine engine. (*Flight Photograph*)

***ARMSTRONG SIDDELEY**—continued.*



A sectional diagram of the Armstrong Siddeley A.S.X. gas turbine.

stage of the compressor; that for the compressor bearings from holes in the compressor drum at the seventh stage. The oil-feed pipe to the rear bearing passes through the larger diameter pipe which carries cooling air to the bearing.

Rearward-acting end thrust on the moving assembly is taken mainly by the front bearings but the load is considerably reduced by the thrust equalising unit. This comprises a chamber kept at full pressure by a lead from the compressor outlet, and a piston keyed to the front shaft and exerting on it a forward thrust.

The large single turbine disc incorporates a forked periphery on which are carried the blades for the two stages. Both front and rear faces of the disc are air-cooled. All the rotor blades have "fir-tree" roots which slide into slots in the disc.

The turbine stator blade rings and stator rings are circular or semi-circular components which together form the turbine outer casing. The stator blades are retained in their slots by the abutment of the components on each side. The blade tips ending in a thin lip, are cut at an angle to follow the conical outer casing which increases in diameter rearwards.

The stator casing is supported by the manifold, or nozzle ring, and by eleven brackets bolted through the back support plate to the air intake throats.

The eleven combustion chambers are of light gauge stainless and heat-resisting steel. Inside these are the smaller flame tubes of approximately similar shape but almost closed at the front end. In the middle of each flame tube is a small mixing chamber into which the primary air for combustion—approximately one-fifth of the total air supply—passes to be mixed with the fuel which is sprayed into it by a jet in the entry duct. Primary combustion takes place in the flame-tube nose and the burning gases flow back over the mixing chamber, heating and vaporising the new fuel fed into it. A portion of the secondary air for combustion enters through a hole in the nose of the flame-tube and by a deflector is directed over the interior surface of the dome to prevent carbon formation in the rich-mixture combustion area. Further air enters the flame-tube through flutes around the base of the domed cap and through holes in the tail section downstream of the mixing chamber. Final mixing of the combustion gases and secondary air is brought about by deflectors just aft of the flame-tube exit.

Fuel is supplied under pressure by a Plessey pump and is passed through a high-efficiency filter to the fuel distributor. Fuel flow is controlled by a Ricardo barostat.

Starting is by rotating the main shaft by an electric motor or special type of gas starter, at a speed of 1,500-2,000 r.p.m. To make this easier provision is made to spill air by suitable valves fitted between the compressor and the combustion chambers. A small quantity of fuel is injected and metered by eleven slow-running jets incorporated in the fuel distributing unit. Combustion is started by two igniter plugs and an ignition coil.

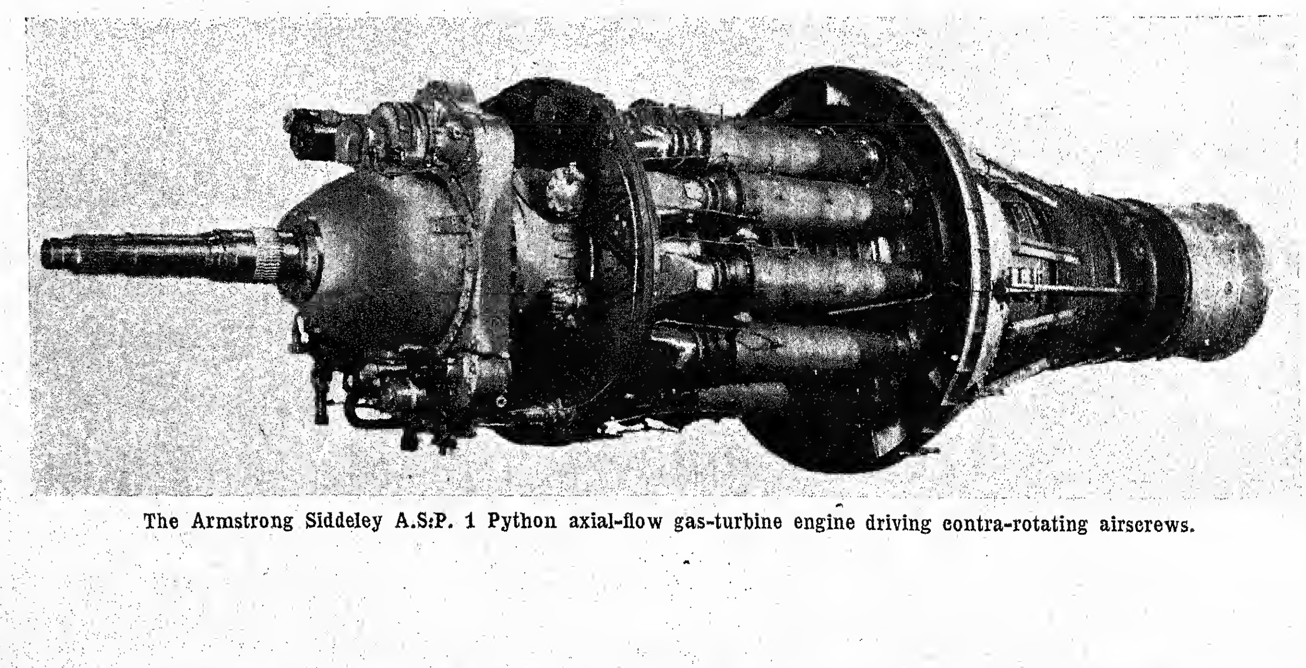
Dimensions.—Maximum diameter 42 in. (1,067 m/m.), Overall length (to propelling nozzle) 168 in. (4,270 m/m.).

Nett Dry Weight.—1,900 lbs. (862.6 kg.).

Performance.—Maximum speed of rotor 8,000 r.p.m., Static sea level thrust (take-off and combat) 2,600 lbs. (1,180 kg.), Fuel consumption at take-off r.p.m. 1.03 lbs./hr./ lbs. thrust, Fuel consumption at cruising r.p.m. 1.0 lbs./hr./lbs. thrust.

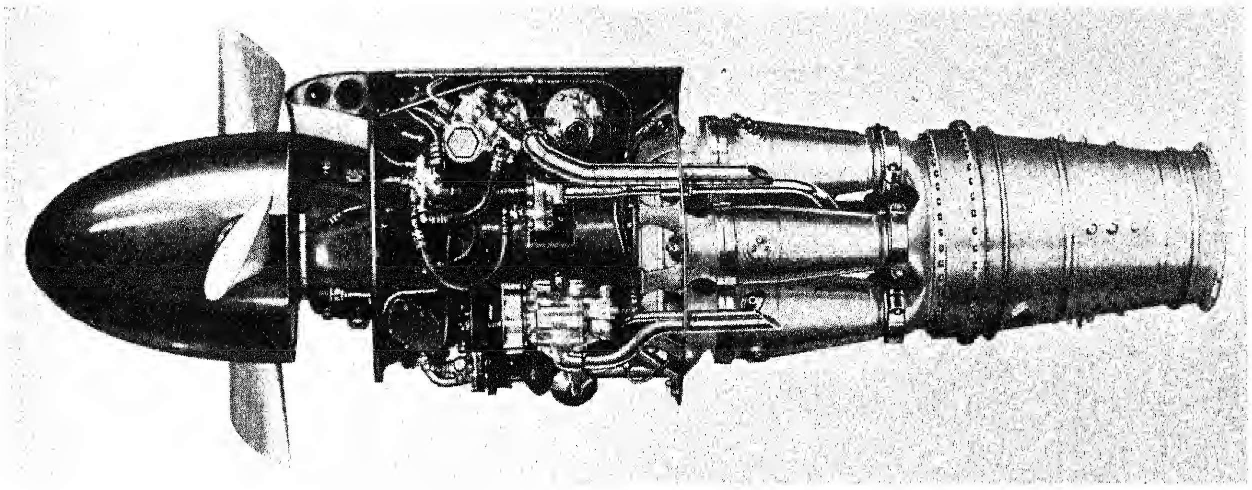
THE ARMSTRONG SIDDELEY PYTHON.

The Python is basically the A.S.X. engine with the addition of a reduction-gear driven from the front end of the compressor, and contra-rotating airscrews. The turbine had also to be redesigned in order to provide the requisite additional shaft



The Armstrong Siddeley A.S.P. 1 Python axial-flow gas-turbine engine driving contra-rotating airscrews.

***ARMSTRONG SIDDELEY**—continued.*



The Armstrong Siddeley Mamba medium-powered axial-flow airscrew gas-turbine.

horse-power. This extra power is provided by arranging for the turbine to expand the gases right down to atmospheric pressure, thus leaving only the minimum possible energy in the exhaust system.

During the design studies which led up to the introduction of the Python, serious consideration was given to the problem of inhaling large volumes of air and it was considered that the lay-out adopted, which consists of placing the compressor intake well back from the airscrew spinner, would prove to be the most efficient. To permit the mounting of the engine in existing aircraft a forward facing annular air intake is provided, while, for more modern aeroplanes intakes ducted from the leading-edge of the wing are provided for.

The reduction-gear unit on the Python is rather bulky in that an overall ratio of 0.123 : 1 is required in addition to the gearing for contra-rotation of the airscrews. Most of the accessories face forward on the accessory casing around the reduction gear and fit neatly behind the spinners. In addition to the A.S.X. accessory drive, the Python is provided with a shaft for driving a remote accessory box at 0.326 times engine speed. At cruising r.p.m. the capacity is 60 h.p.

The fuel and control system for the Python is arranged to give a single lever cockpit control over the whole of the power range from slow running to full power. Each position of the pilot's lever selects the appropriate airscrew speed and also ensures that the correct amount of fuel is fed to the engine to give the optimum performance at the rotational speed, the necessary corrections for altitude, forward speed and air temperature being made automatically.

Starting is arranged by means of press buttons in the pilot's compartment and can be effected either by means of the starting motor provided or by taking advantage of the power supplied by the airscrew wind-milling when the aircraft is in flight.

A feature of airscrew gas-turbine engines is that the power available falls rapidly with a decrease in engine r.p.m. In the case of the Python when running at half speed, that is to say in the slow-running condition, the power is less than 100 h.p. With the airscrew also running at half speed the normal fine pitch slots cannot be used because, in order to absorb as little power as possible, the airscrew must slow-run in practically zero pitch. This is arranged for by removing the fine pitch stop and at the same time ensuring, by means of a special device in the reduction gear, that the constant-speed mechanism of the airscrew is put out of action when the engine is being driven under wind-milling conditions.

A problem with large gas turbine engines is the necessity for providing the necessary starting torque for a comparatively long period. The actual torque required is less than that for a piston engine of comparative power, but the time for which it is required is much greater. This would mean an impossible drain on the batteries if an electric starter were used and in addition the weight of the starter and cables would be excessive. To meet this difficulty a special gas-starter motor was developed for the Python. This special starter may also be used as an alternative to the electric starter on the A.S.X.

The S.P.1-1 model with annular intake and the S.P.1-2 model with twin-duct intake are both mounted through eleven brackets located at the rear of the intake casing. All pipes, controls and cables which connect to the aircraft pass between the combustion chambers and the air-intake throats to a bulkhead behind the mounting brackets.

DIMENSIONS (S.P.1-1 with annular intake).—Maximum diameter (over engine cowl) 54.5 in. (1,285 m./m), Length from mounting flange to centre-line of rear airscrew 85 in. (2,160 m/m.), Overall length 136 in. (3,965 m/m.).

DIMENSIONS (S.P.1-2 with twin-duct intakes).—Maximum diameter (over engine cowl) 48 in. (1,220 m/m.), Length from mounting flange to centre-line of rear airscrew 93.5 in. (2,380 m/m.), Overall length 136 in. (3,965 m/m.).

WEIGHTS (S.P.1-1).—Nett dry weight 3,010 lbs. (1,366.5 kg.), Estimated installed weight (including airscrews) 4,100 lbs. (1,861.4 kg.).

WEIGHTS (S.P.1-2).—Nett dry weight 2,980 lbs. (1,352.9 kg.), Estimated installed weight (including airscrews) 3,950 lbs. (1,793.3 kg.).

PERFORMANCE.—See Table below.

Rating	Engine Speed	Aircraft Speed	Airscrew Shaft Horse-power	Nett Jet Thrust	Fuel Consumption per hour
				lbs.	Imp. gallons
Maximum Take-off Maximum combat	8,000 r.p.m.	0 m.p.h.	3,670	1,150 (522 kg.)	359 (1,632 litres)
		200 m.p.h. (322 km.h.)	3,950	760 (345 kg)	359 (1,691 litres)
		300 m.p.h. (483 km.h.)	4,290	590 (267 kg.)	385 (1,750 litres)
		400 m.p.h. (644 km.h.)	4,860	420 (191 kg.)	401 (1,823 litres)
		500 m.p.h. (805 km.h.)	5,520	280 (127 kg.)	425 (1,932 litres)
Maximum climb	7,800 r.p.m.	0 m.p.h.	3,150	1,060 (481 kg.)	323 (1,469 litres)
		200 m.p.h. (322 km.h.)	3,450	660 (299 kg.)	334 (1,519 litres)
		300 m.p.h. (483 km.h.)	3,800	490 (222 kg.)	346 (1,573 litres)
		400 m.p.h. (644 km.h.)	4,200	320 (145 kg.)	361 (1,641 litres)
		500 m.p.h. (805 km.h.)	4,950	170 (77 kg.)	384 (1,746 litres)
Maximum continuous cruising	7,600 r.p.m.	0 m.p.h.	2,720	950 (431 kg.)	290 (1,318 litres)
		200 m.p.h. (322 km.h.)	2,960	570 (259 kg.)	800 (1,364 litres)
		300 m.p.h. (483 km.h.)	3,260	390 (177 kg.)	308 (1,400 litres)
		400 m.p.h. (644 km.h.)	3,680	220 (100 kg.)	325 (1,478 litres)
		500 m.p.h. (805 km.h.)	4,250	60 (27 kg.)	341 (1,550 litres)

THE ARMSTRONG SIDDELEY MAMBA.

The Mamba is in effect a smaller and lower-powered version of the Python and is suitable for feeder-line or transcontinental aircraft types. It is an axial-flow gas turbine driving a single 10 ft. (3.05 m.) Hydromatic airscrew and was designed to give a sea-level take-off output of 1,000 shaft h.p. plus 320 lbs. (145 kg.) jet thrust. The engine is arranged for straight-through flow, the air-intake being arranged immediately aft of the airscrew spinner. After compression the air flows directly from the compressor exit into six combustion chambers and thence directly through the axial-flow turbine and exhaust system to the atmosphere. Nowhere in the engine, from the intake to the exhaust jet, is the general flow of the air altered substantially from an axial direction.

The overall diameter and frontal area of the Mamba are 2 ft. 3 in. (0.69 m.) and 4 sq. ft. (0.37 sq. m.) respectively. The weight is 750 lbs. (340 kg.), or approximately 1,000 lbs. (454 kg.) with the airscrew fitted.

The Mamba is still under development. Two are to be fitted to the Miles M-69 version of the Marathon airliner.

BRISTOL.

BRISTOL AEROPLANE CO., LTD.

HEAD OFFICE AND WORKS: FILTON, NR. BRISTOL.
Directors: See p. 16d.
Chief Engineer (Gas-Turbines): F. M. Owner, M.Sc., F.R.Ae.S. M.S.A.E.

For many years the Bristol Aeroplane Co. Ltd. has been interested in the gas turbine in its various forms.

As far back as 1924-25 the company was actually flying a Bristol exhaust turbo-supercharger on an adapted Jupiter engine. It was flown successfully at over 30,000 feet and proved very promising, but the state of engine development then made it necessary to concentrate on gear-driven superchargers from 1926 onwards.

Work was resumed on exhaust-turbos in 1937, when the line of development envisaged by the company was a turbo-blown version of the sleeve-valve engine—the idea being that boost and back-pressure could be progressively increased, as the sleeve-valve was very well suited to operate at high back-pressure. Thus a state of affairs would ultimately be reached where the powers of the engine and of the exhaust-turbo were equal and it would so be possible to interchange airscrew and compressor, thereby making the engine and compressor virtually a gas generator unit, the airscrew being driven by the exhaust turbine.

By the outbreak of war, Bristol had a general plan for entry into the gas turbine field. The primary aim was the production of a compound unit of low fuel consumption, a feature which would make it peculiarly applicable to long-range aircraft.

Initial testing was cut short by the outbreak of the War, but theoretical work was continued and investigations into the possibilities of a piston engine and gas-turbine combination were made. These studies were given an additional impetus by Air Cdre. Whittle's success in jet propulsion work.

The Bristol Aeroplane Company felt that since their experience lay chiefly in installations for large and long-range aircraft, any form of gas turbine which might be considered should be designed with such application in mind. As a result the general policy of concentrating on units of high thermal efficiency was formulated. It was appreciated that this general policy would necessitate the design of units suitable for aircraft of moderate cruising speeds, namely 300 m.p.h. (480 km.h.) increasing in about 5 years or so to 400 m.p.h. (640 km.h.). At these speeds the propulsive efficiency of the pure jet is low and accordingly design work has been concentrated primarily on propeller turbine engines, because it is generally recognised that the propeller is the most efficient means of propulsion for speeds up to approximately 500 m.p.h. (800 km.h.).

The primary target aimed at, therefore, was the design of a propeller turbine having a fuel consumption comparable to that of a piston engine at 300 m.p.h. (480 km.h.) and 20,000 ft. (6,100 m.). These conditions were chosen as being the most arduous for efficient operation of a gas-turbine, because at higher speeds and altitudes, the efficiency of the gas-turbine is increased.

Of the various methods of obtaining a high thermal efficiency from a gas turbine, the idea of utilising the waste heat of the exhaust gases looked very promising and so a heat exchanger was designed to transfer this heat to the compressor delivery air at a point ahead of the combustion chambers. The adoption of the heat exchanger permitted the use of well established compression ratios and operating temperatures.

Design work along the lines described above has resulted in the manufacture of the Theseus propeller turbine engine, which has now completed several hundreds of hours of bench testing including a 100 hours endurance run at operating conditions with most satisfactory results.

Initial flight testing of the Theseus is being made on an Avro Lincoln, which has the two outboard reciprocating plants replaced by Theseus propeller turbines.

Future plans for the Theseus will be fixed in relation to the company's Turbine Department's other commitments, which include the development of the Proteus propeller turbine engine to power the Brabazon I, Mark II. The only information which can be released about the Proteus engine is that its power will be of the order of 3,500 h.p.

The Theseus was the first airscrew turbine to pass the British official Type Test for engines of this type. Four Theseus I engines has been specified as the power-plant of the Handley Page Hermes V Airliner.

THE BRISTOL THESEUS I.

The Theseus I gas-turbine consists of an axial-flow compressor combined with a centrifugal stage and driven by a two-stage turbine. The air after passing through this compressor is delivered to a heat exchanger which raises its temperature by heat transfer from the hot exhaust gases. The air then passes through the combustion chambers to the first two-stage turbine where part of the energy of the charge is used to drive the compressor. After this the gases pass through the third single-stage turbine (where power is absorbed to provide the drive to the airscrew) and then pass through the hot side of the heat exchanger. Their residual energy is finally dissipated in the exhaust nozzle to provide an appreciable amount of jet thrust. The main proportion of available power is transmitted from the third stage turbine to a conventional tractor airscrew *via* an epicyclic reduction gear.

The ratio of power used in driving the airscrew to that used in providing jet thrust is roughly in the proportion of 80% to 20% at 300 m.p.h. (480 km.h.).

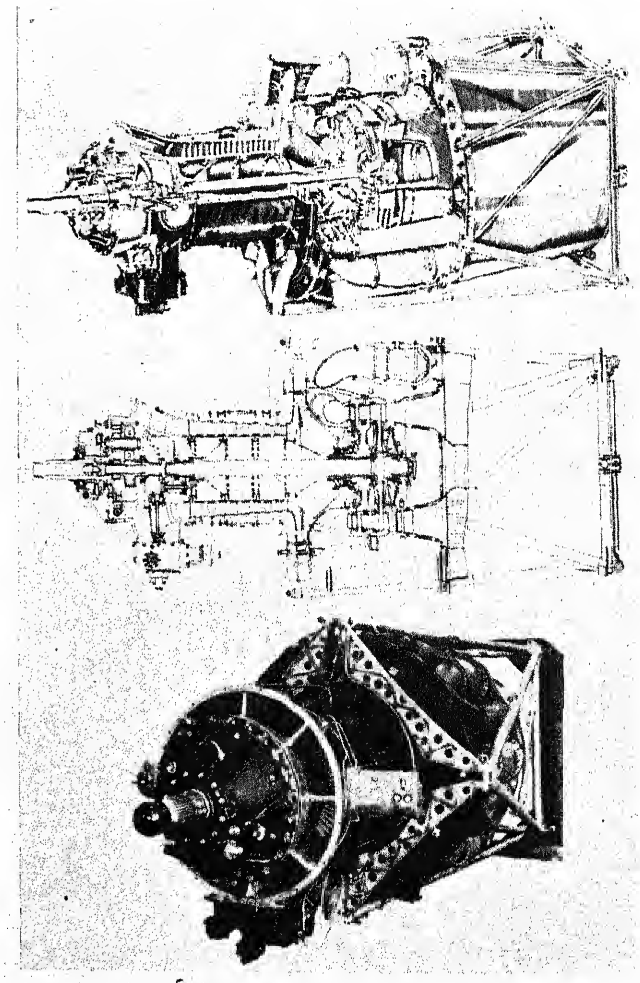
COMPRESSOR.—Compressor consists of nine stages of axial blading combined with a single-stage centrifugal impeller giving an overall compression ratio of approximately 5 : 1 when flying at 300 m.p.h. (480 km.h.) and 20,000 ft. (6,100 m.). The compressor rotor is of drum construction, being made of a high-grade aluminium-alloy forging. The drum is made up of three identical sections for ease of manufacture and assembly and is supported by two conical steel shafts bolted to the drum and carried in a front roller-bearing and a rear ball-bearing which also supports the compressor turbine wheel. The rotor blades, as in the case of the stator blades, are made from high-grade aluminium-alloy stampings and are fixed to the rotor drum by means of serrated slots running axially. There are nine stages, each of which contains 69 blades. The compressor runs at 8,200 r.p.m. at full-throttle conditions and delivers 30 lbs. (13.6 kg.) of air per second at sea level static conditions. The power required to drive this is approximately 3,500 h.p. The impeller is machined from a solid aluminium forging and is bolted on to the axial rotor drum to form the final stage of compression. The impeller has 23 straight radial vanes and is double-shrouded.

INTAKE CASING.—An aluminium-alloy casting consisting of an inner and outer shell, connected to each other by eight radial and hollow vanes of aerofoil section. The whole of the intake casing is cast in one and provision is made for the attachment of the starter motor on the horizontal centre-line as well as for an oil sump at the bottom. The inner shell accommodates the reduction gear and auxiliary gear casing, drives being led through the hollow vanes to the starter and oil sump.

COMPRESSOR CASING.—The main compressor casing is also made of aluminium-alloy and is cast in two halves. The axial section and part of the centrifugal one is of double-skin construction so as to relieve that portion of the compressor carrying the stator blades of stresses due to propeller loads. The rear portion of this casing forms the front face of the centrifugal impeller chamber and together with the delivery manifold and rear casing forms the centrifugal stage of the compressor. Blow-off valves are incorporated for starting purposes.

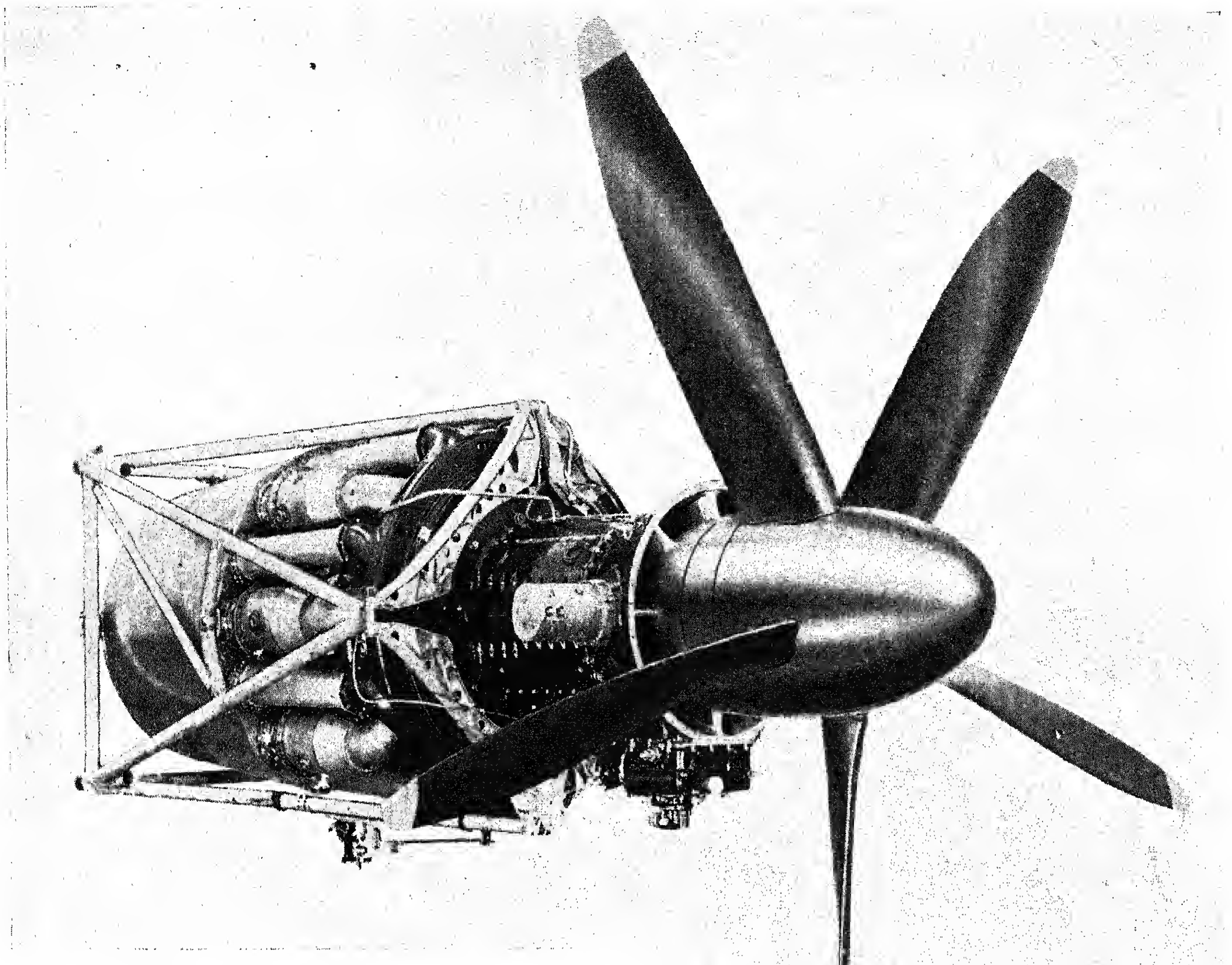
DELIVERY MANIFOLD AND REAR CASING.—The delivery manifold collects the compressed air from the impeller after suitable diffusion through the vane ring and passes it to the cold side of the heat exchanger through eight transfer pipes. It is a one-piece magnesium casting in contrast to the diffuser vane ring which is cast in two halves, also of magnesium. The rear casing is an aluminium casting which forms the back face of the centrifugal impeller chamber and is extended backwards to carry the main compressor thrust-bearing. It is joined to the compressor casing by means of long bolts running through the diffuser vanes.

HEAT EXCHANGERS.—Air is delivered from the compressor discharge manifold to the heat exchanger by means of eight aluminium



Three views of the Bristol Theseus I Gas Turbine.

***BRISTOL**—continued.*



The Bristol Theseus I Gas Turbine.

diffusing transfer-ducts spaced equally around the periphery of the engine. Exchanger of matrix-type construction consisting of some hundreds of straight tubes running parallel to the axial centre-line. Tubos are arranged in 16 sets, 8 inlet and 8 outlet, each batch separated from the next by suitable headers. Air passes radially inwards towards the centre of the heat-exchanger where its direction is reversed and it travels radially outwards again to the outlet headers. During its passage through the heat exchanger the air picks up heat from the hot exhaust gases and from the outlet headers it is passed into the combustion chambers.

COMBUSTION CHAMBERS.—Tho combustion chambers which are spaced between the transfer ducts around the poriphery of the engino, are of standard design and of sheet metal construction throughout. Provision is made for the admission of secondary cooling air to the burning mixture in order that the temperature may be lowered to a value acceptable to the turbine blade materials. The chambers are interconnected for even flame distribution and equalisation of pressure and two are provided with sparking plugs for initiating combustion during starting. Full provision made for accommodating any expansion which may occur.

TURBINES.—Products of combustion are delivered to the first-stage nozzles through a tangential delivery manifold. These nozzles, of which there are 48, direct the gases on to the first-stage rotor blades, after which the gases are re-directed on to the second-stage rotor blades by the second-stage stators. Both these first two stages of rotor blades are fixed to the same wheel disc and the power generated is used to drive tho compressor and auxiliaries only. After leaving the compressor driving wheel the gases pass through a third-stage of stator blades to be guided on to a single-stage rotor wheel, which is coupled to the propeller reduction gear. The propeller turbine revolves at a speed of 9,000 r.p.m. The gases are then led through a diffuser to tho hot side of the heat exchanger, after which they are discharged from the jet pipe, which has a variable nozzle. The compressor driving wheel carries tho first two stages of rotor blades and is of forged high-temperature-resisting steel to Jessop's specification G. 18B. A hollow hub is forged integral with the disc and is splined to transmit the drive to the compressor shaft. The propoller driving wheel is a Staybrite forging, carrying a single row of rotor blades and having an integral forged stub shaft to provide the support from the rear bearing. The extended driving shaft is bolted directly to the disc and transmits the drive to the epicyclic reduction gear. The rotor blades are forged from a special heat-resisting alloy, and are of the Free Vortex type. They are fixod to the wheels by means of "fir-tree" typo slots, obtained by broaching. The turbine casing is formed from three separate castings made of high-grade heat-resisting steel, the third stage casing also providing a support for the rear bearing of the propeller drive and turbine, by means of eight radial vanes. The turbine assembly is mounted separately from the rest of the unit by moans of a secondary triangulated structure, supported from the main mounting face. This permits the accommodation of any longitudinal expansions and, in addition, the turbine mounting provides for freedom of expansion in the radial direction while maintaining concentricity. Provision is made for the cooling of the turbine wheels by means of tappings from the axial compressor. A system of labyrinths provides effective sealing between the various stages of the turbinc.

REDUCTION GEAR.—Epicyclic type, driven from the propeller turbine wheel by means of a long shaft running through and co-axial with the compressor assembly. This shaft is supported on a roller-bearing at the front and a ball thrust-bearing at the rear. At the forward end the shaft drivos through a gear-typo coupling to the sun whoel of the reduction-gear. The sun wheel drives the larger gears of four sets of compound planets carried in a cage, bolted to the propeller shaft. The action of the smaller planet wheols on a fixed annulus gear causes the planet cage and hence the propeller shaft to rotate at tho speed required, which is approximately 1,070 r.p.m., the reduction gear ratio being approximately 8.4 : 1. The fixed annulus gear is mounted on torquo dynamometer pistons and this provides the additional advantage of equalising the tooth loads on all the planet wheels. A single-row ball-bearing is provided to carry the thrust of the propeller.

PROPELLER.—Provision made for feathering and roversing propeller and Standard No. 5 propeller shaft is specified. Direction of rotation is left-hand tractor.

AUXILIARY DRIVES.—An oil-sump is provided underneath the intake casing and incorporates drives to the oil pressure and scavenge-pumps and a fuel-pump. The drive to these pumps is taken from the compressor rotor *via* bevel gears contained in an auxiliary gear-casing which is in turn housed within the intake casing. The auxiliary gear casing includes the drive from the starter motor, situated on the horizontal centre-line of the intake casing. The starter-motor drives through conventional type Bendix jaws to the

BRISTOL—*continued.*

compressor-rotor. The device for controlling the propeller pitch-change mechanism is also included in this casing.

BEARINGS.—There are six main bearings in the Theseus I gas turbine, two of which carry the propeller shaft, two the compressor rotor assembly and the other two the propeller turbine wheel and its driving shaft. The rear compressor bearing and the rear propeller turbine bearing are single-row ball-bearings capable of carrying all the resultant thrust. In the case of the rear compressor bearing the thrust of the compressor is balanced against the thrust of the turbine in so far as it is possible, so that the bearing only has to carry the resultant thrust. In both the compressor and propeller turbine rotor assemblies, the forward bearings are roller types in order to allow for the differential longitudinal expansion between the casings and the rotors.

MOUNTING.—The unit is mounted in a symmetrical triangulated structure which is designed to pick up directly from four suitable points. The engine is supported in this frame by four fabricated steel mounting beams which bolt on to the front of the centrifugal section of the compressor casing. The turbine assembly as has been explained previously is mounted separately from the main mounting face. The heat-exchanger is mounted at the front end from points halfway along the main mounting members and at the rear from the rear framework almost in line with the pick-up points. Ample provision is made to cater for expansions in this assembly.

OIL SYSTEM.—The only parts requiring lubrication are the bearings and reduction-gear and the auxiliary-gear drives. This is provided for by the oil-sump and pumps already mentioned and a small oil-cooler for the dissipation of the frictional heat generated by the reduction gear.

FUEL SYSTEM.—The fuel system is of the design developed by Joseph Lucas, Ltd. and incorporates a fuel pump, a barometric control, accumulator and dump valve and fuel injectors. The fuel employed is Kerosene to the latest specification (Specific gravity .810 max.). Alternative fuels may be used for special purposes with the agreement of the engine manufacturers.

CONTROL SYSTEM.—Single-lever control will be provided. This will normally operate the fuel delivery only to obtain the appropriate propeller-speed for any given flight condition. If desired, however, this lever may be arranged to control also propeller feathering and reversing. Propeller pitch-control under normal conditions is entirely automatic.

AUXILIARY GEAR BOX DRIVE.—Taken from the rear of the propeller-turbine *via* an extension shaft and gear-box mounted on airframe bulkhead.

JET PIPE.—Ducts leading to the control discharge jet decided by aerodynamic and other features of the particular aircraft installation, but remote automatic control provided to actuate the flap of the jet control.

STARTING.—Starting is effected by energising the electric starters to accelerate the compressor, after which the fuel is injected and ignited. This sequence is entirely automatic and is controlled solely from the starter switch.

DIMENSIONS.—Overall diameter 48 in. (1,219 m/m.). Overall length (cone fitting line to engine-mounting centres) 106 in. (2,692 m/m.).

NETT DRY WEIGHT.—2,130 lbs. (966 kg.).

PERFORMANCE.—Maximum power output (I.C.A.N. conditions). (*a*) Sea level (static) 1,950 B.H.P. plus 500 lbs. (227 kg.) jet thrust; (*b*) Sea level (300 m.p.h.=483 km.h.) 2,350 equivalent B.H.P.; (*c*) at 20,000 ft. (6,095 ft.) (300 m.p.h.=483 km.h.) 1,500 equivalent B.H.P. Fuel consumption (*a*) Maximum power (sea level at 300 m.p.h.=483 km.h.) 0.57 lbs. (0.26 kg.) equivalent B.H.P./hr., (*b*) Maximum power (at 20,000 ft.=6,095 m. at 300 m.p.h.=483 km.h.) 0.50 lbs. (0.227 kg.) equivalent B.H.P./hr.

DE HAVILLAND.

THE DE HAVILLAND ENGINE CO., LTD.

HEAD OFFICE: STONEGROVE, EDGWARE, MIDDLESEX.

Directors: See p. 23d.

The de Havilland Engine Co, Ltd. entered the jet-propulsion field in the Spring of 1941. Design of the first D.H. jet engine—the H-1 or Goblin—began in April, 1941, and within a year the prototype was running on the Hatfield test-beds. Within two months the engine was giving its designed thrust, by March 5, 1943, it was flying in a Gloster Meteor, and by September 20, 1943, it was taking the D.H.100 Vampire single-seat single-jet fighter monoplane on its initial flights.

A D.H. H-1 was supplied to the American authorities in July, 1943, and this engine was turned over by the U.S. Air Technical Service Command to the Lockheed Aircraft Corporation to form the power unit of the XP-80 Shooting Star single-seat fighter monoplane. This aircraft was designed, built and flown in 143 days.

The Goblin went through its test with no fundamental changes in design development being concentrated on detail improvement. In January, 1945, the engine passed the British official type-test in the new Gas Turbine category and holds Approval Certificate No. 1.

The production Goblin II is rated at 3,000 lbs. (1,361 kg.) thrust at 10,200 r.p.m. and this unit gives the standard R.A.F. Vampire fighter a normal level top speed of 540 m.p.h. (869 km.h.) over a wide altitude range. Development Goblins are running at considerably higher powers and Vampire aircraft are flying with special category approval at 3,400 lbs. (1,542 kg.) thrust.

The latest D.H. gas turbine is the Ghost, an enlarged version of the Goblin which develops a static thrust of 5,000 lbs. (2,270 kg.).

THE D.H. GOBLIN II.

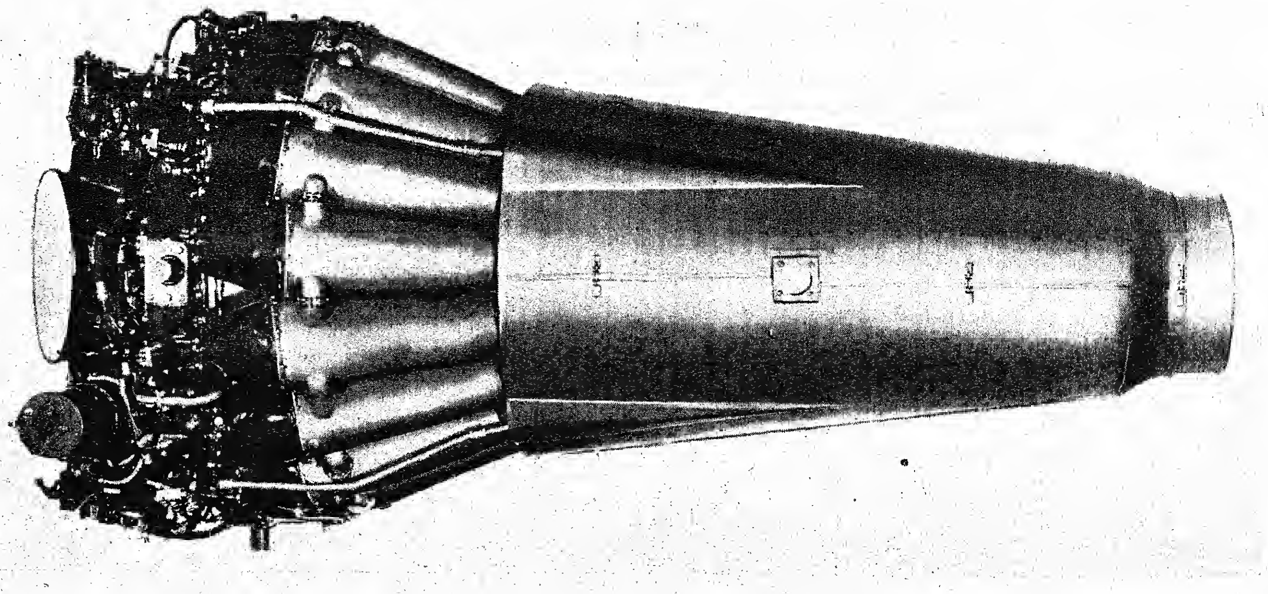
TYPE.—Centrifugal-flow turbo-jet with single-stage turbine.

COMPRESSOR.—Single-stage compressor with single-sided impeller. Impeller fabricated from heat-treated aluminium stamping, has 17 vanes and is 31 in. (78.74 c/m.) in diameter. Pivot shaft is shrunk in and is bolted on to front face of impeller and carries the bevel gear which drives the accessories shaft. Main tubular shaft runs on two ball bearings, the rear bearing in a sliding housing to allow for rearward expansion. Compression ratio 3.30 : 1.

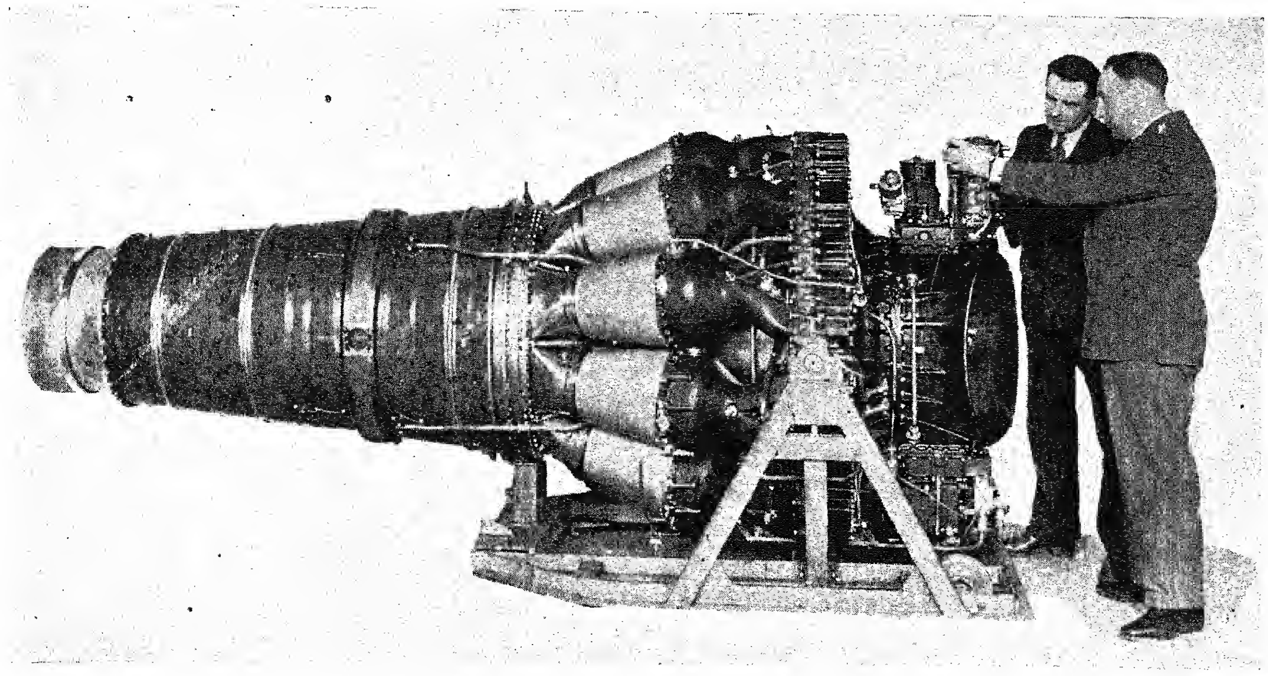
COMPRESSOR HOUSING.—In three sections. Front section, of aluminium alloy, is a ribbed unit forming the two entry orifices and carries the front bearing of the rotor assembly and all auxiliaries with their bevel drive gears. The other two sections, in magnesium alloy, form the vertically split diffuser. A conical steel centre casing forms the main lengthwise member of the engine structure. The four pick-up bolts by which the engine is mounted originate from the centre casing and pass through the diffuser casing. The small end of the centre cone is fixed to the rear bearing housing just in front of the turbine disc.

COMBUSTION CHAMBERS.—Sixteen straight-flow chambers with their upstream ends bolted to the rear face of the diffuser chamber and their downstream ends provided with a sliding fit, with piston-ring seals, in the turbine nozzle junction box assembly. Chambers are double-walled, the main combustion air being supplied to the inner chamber, or flame tube, through a metering annulus and a series of vanes designed to create a back vortex and prevent the flame being blown out. Rest of the air enters the flame tube through rings of ports about halfway along.

TURBINE.—Single-stage turbine. Turbine disc of special ferritic steel with 83 blades mechanically attached in serrated slots broached in the periphery of the disc. The slots are parallel-sided and are lightly peened on each side. Blades are of special high-nickel-



The de Havilland Goblin II centrifugal-flow Gas Turbine. The Goblin was the first Gas Turbine to pass the British official type test for engines of this class.



The D.H. Ghost centrifugal-flow Gas Turbine. Maximum static thrust, 5,000 lbs. (2,270 kg.).

content non-ferrous alloy. Turbine housing ring is supported from the main casing by a cylindrical sheet-steel skirt which connects the nozzle ring at its inner periphery with the conical centre casing about half-way along its length, and by a diaphragm plate which connects the nozzle ring with the rear bearing housing

Jet Pipe.—Sheet steel jet pipe, bolted to turbine shroud ring, tapers to an orifice 16 in. (40.64 c/m.) in diameter. Within the jet pipe is an inner cone of sheet steel supported by two pairs of radial streamline stays. Annular heater muff for warming aircraft cabins, guns, etc. is built on to outside of jet pipe. The pipe is finally enclosed in a cowling through which air for cooling and insulating is drawn rearward by the suction of the jet itself. Jet pipe temperatures 700°C. maximum, 550°C. cruising, 630°C. climbing.

Fuel System.—Fuel is fed from the aircraft fuel system either by gravity or by pressure pump, preferably the latter. Engine fuel pump of the rotary type with seven plungers reciprocating in a cylinder block rotating round a central stationary shaft containing the suction and delivery ports. The pistons are operated by aluminium slippers flung outwards centrifugally into contact with an eccentrically disposed ring. Pump rated at 650 Imp. gallons (2,955 litres) per hour at 800 lbs./sq. in. (56.25 kg./sq. c/m.) at 3,500 r.p.m. (10,500 r.p.m. engine speed). From pump, fuel passes through fuel control box containing metering orifice, the area of which is controlled from pilot's cockpit. There is also an automatic altitude control barostat. From fuel control box fuel passes to an overspeed centrifugal governor, fuel accumulator, an automatic starting valve, and automatic pressure switch and into the burner supply ring. Flow of fuel controlled by a high-pressure fuel distribution valve situated immediately after the fuel control box and is operated by a separate level in the cockpit. The fuel accumulator is provided to ensure that a sufficient quantity of fuel available for efficient starting and in conjunction with the automatic starting valve automatically ensures that the fuel is at the correct pressure for starting. The automatic starting valve is set so that the accumulator cannot discharge its contents into the burner distributor ring until the fuel pressure has risen to about 40 lbs./sq. in. (2.8 kg./sq. c/m.). Automatic pressure switch prevents full power of starting motor being applied until there is full pressure in the burner ring, indicating that fuel is being delivered to burners.

Lubrication.—Oil sump of about 12 pints (6.825 litres) capacity bolted on to one of the accessory drive gear boxes on the front casing. Gear-type pressure pump delivers oil to accessories and their drives, and two metering pumps attached to and fed by pressure pump deliver about ½ pint (0.284 litre) per hour each to the two bearings of the rotor assembly. Oil from the compressor-end bearing returns to the sump while that from the turbine end is lost. Main oil pressure 50 lbs./sq. in. (3.5 kg./sq. c/m.). Normal oil pressure at cruising r.p.m. 40-45 lbs./sq. in. (2.8-3.2 kg./sq. c/m.) at 8,700 r.p.m.

Starting.—Interconnected fuel and ignition system by which rotor is slowly spun up to a speed where sufficient air flows through to ensure ignition before any fuel is admitted. When this stage is reached an automatic valve allows fuel to be injected into burners from fuel accumulator. Igniter plugs in two combustion chambers are then automatically energised. Interconnecting passages between all chambers ensure complete combustion.

Mounting.—Four bolts attached to central casing pass through diffuser casing to four pick-up points. Alternative mounting is provided by four pads on the periphery of the diffuser casing, of which either three or all four can be used.

Fuel.—Aviation kerosene RDE/F/KER Issue I.

Dimensions.—Length to exhaust cone flange 100.5 in. (2,550 m/m.), Maximum diameter 49.85 in. (1,260 m/m.), Installed diameter (Vampire) 54 in. (1,370 m/m.), Internal nozzle diameter 16 in. (40.64 c/m.).

Nett Dry Weight (including oil tank).—1,550 lbs. (704 kg.) ± 2.5%.

Performance.—Maximum static thrust 3,000 lbs. (1,361 kg.) at 10,200 r.p.m., Cruising static thrust 1,850 lbs. (840 kg.) at 8,700 r.p.m., Idling static thrust 150 lbs. (68 kg.) at 150 r.p.m.

THE D.H. GHOST.

The Ghost is the second turbo-jet produced by the de Havilland company. Although larger than the Goblin, it has the same basic features of the lower-powered engine, including a single-sided impeller, single rigid rotating assembly, straight-through combustion, single-stage turbine and cantilever mounting. The Ghost has ten large combustion chambers instead of the sixteen smaller chambers of the Goblin.

The Ghost is delivering a static thrust of 5,000 lbs. (2,266 kg.), equivalent to 8,000 true thrust horse-power at 600 m.p.h. (966 km.h.) at sea level and corresponding to 12,000 h.p. from a normal aero-engine, assuming an airscrew efficiency of 66%.

Dimensions.—Length 122.6 in. (3,130 m/m). Maximum diameter 53 in. 1,345 m/m.

Nett Dry Weight.—(1,950 lbs.). 885.3 kg.

Performance.—Maximum static thrust 5,000 lbs. (2270 kg.).

FEDDEN.

ROY FEDDEN, LTD.

Head Office and Works: Stoke Orchard, near Cheltenham, Glos.

Chief Engineer (Gas-turbines): D. R. Amor.

Roy Fedden, Ltd. was formed in 1945 to specialise in the design and development of low-drag power-units for small and medium-sized aircraft.

One of the first projects of the company is a propeller gas turbine which is being specially developed to the requirements of the Ministry of Supply. It is intended primarily for twin or four-engined civil transports operating over short or medium ranges at altitudes up to 30,000 ft. (9,145 m.) and at cruising speeds of from 300 to 350 m.p.h. (483 to 563 km.h.). It should also be suitable for military transport and reconnaissance aircraft.

The Fedden propeller gas-turbine consists of three main units; an axial-flow compressor; the combustion system; and a turbine which drives the compressor and supplies power to the propeller reduction-gear. The power unit is only 27 in. (686 m/m.) in diameter and with its lubrication system and air intake forms a complete and unified power-plant. All pipes, wires and controls are conveniently grouped and the engine is bolted to the airframe by a four-point attachment. Structural details are restricted by the conditions of the Government contract under which the engine is being built. The following brief particulars include an estimation of performance.

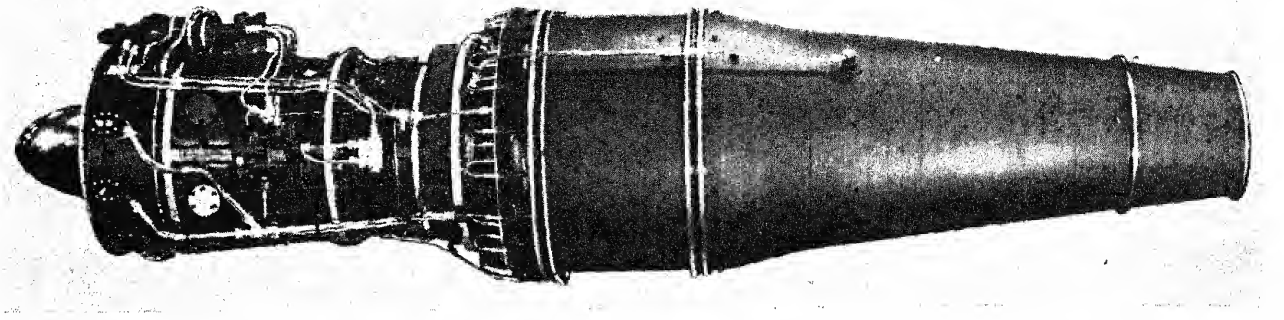
Nett Dry Weight.—750 lbs. (340.5 kg.).

Dimensions.—Diameter over cowling 27 in. (686 m/m.), Length (propeller cone datum to apex of exhaust cone) 74 in. (1,870 m/m.).

Performance.—

	Ground level Static (full (r.p.m.)	Cruising 300 m.p.h. (483 km.h.) 10,000 ft. (3,050 m.)	Cruising 300 m.p.h. (483 km.h.) 20,000 ft. (6,095 m.).
Propeller r.p.m.	1,275	1,400	1,400
Propeller s.h.p.	1,305	875	710
Jet equivalent s.h.p.	120	70	75
Total equivalent s.h.p.	1,425	945	785
Accessory drivo r.p.m.	2,600	2,470	2,470
Fuel consumption lb./hr. (kg./hr.).	948 (430)	605 (274.6)	456 (207)

METROVICK.



The Metrovick F.2 Series IV axial-flow Gas Turbine which has a maximum thrust rating of 3,500 lbs. (1,590 kg.).

METROPOLITAN-VICKERS ELECTRICAL CO., LTD.

Registered Office: 1, Kingsway, London, W.C.2.

Works: Trafford Park, Manchester, 17.

Metropolitan-Vickers started development work on gas turbines for aircraft propulsion in 1938, and in 1940 designed the F.2 jet propulsion engine with axial-flow compressor. The first engine was run on bench test in 1941 and, after modification passed a Special Category Test for flight clearance in 1942. The earliest flights with engines of this type took place in a Lancaster flying test-bed on June 29, 1943, and in a Gloster F.9/40 Meteor prototype on November 13, 1943.

This first engine, known as the F.2 Series I, had a thrust rating of 1,800 lbs. (817 kg.) on a weight of 1,525 lbs. (692 kg.). It had a maximum diameter of 32.9 in. (835 m/m.) and a length of 128 in. (3,251 m/m.).

This was followed by an engine of a new design known as the F.2 Series IV. The first engine of this type was run in 1945.

Metropolitan-Vickers has also developed both ducted-fan and open-fan augmenters for incorporation with the standard F.2 turbo-jet unit. The unit embodying the ducted fan is known as the F.3 and that employing the open-fan augmenter as the F.5.

THE METROVICK F.2 SERIES IV.

Type.—Axial-flow gas turbine, with 10-stage compressor, annular-flow combustion and single-stage turbine.

Compressor.—Ten-stage axial-flow compressor drum and rotor extension on two main bearings, the front a thrust bearing. RR.56 light alloy forgings. Compression drum made in two pieces bolted together at internal joint where the front bearing support member—a steel forging—is also secured. Attachment of blades to compressor drum is by serrated roots in axial grooves machined in the drum, with spacers between the rows. Each axial row of blades locked by peening each end of grooves. Compression ratio (static) 4:1.

Compressor Casing.—Cast in RR.50 light alloy, ribbed externally and fully machined internally. In three main sections, inlet branch, compressor barrel and outlet branch. Fixed, or stator, blades machined from RR.56 light alloy pressings and secured in casing by dovetail-section axial grooves with spacers between. The outlet branch has a rearward extension to carry rear, or turbine, bearing.

Combustion Chamber.—Annular type. Inlet cover is a one-piece casting ribbed externally and with integral bosses for twenty burners. Combustion chamber of austenitic steel sheet. Air entering the chamber is split into primary and secondary air; the primary air being metered through holes in the front end plate to give required quantity of oxygen for combustion. Fuel is sprayed in upstream direction through twenty burners, each shrouded by a tubular heat-resisting shield. Secondary air is fed into combustion chamber through inner and outer rings of hollow "wedges" to mix with products of combustion. Two igniters with integral fuel sprays.

Turbine.—Single-stage turbine disc machined from molybdenum-vanadium steel with blades secured by bulb roots. Fixed blades riveted to nozzle diaphragm. For cooling, small quantities of air are bled from the compressor outlet and fed into space between nozzle diaphragm and turbine disc. This air, after passing over front face of disc and cooling roots of moving blades, joins main gas stream. Rear face of disc cooled by air tapped from outlet branch and led *via* external pipes to cross tubes supporting exhaust cone bullet and then forward through central tube to deflector plate in front of disc. Cooling of tip and roots of entire turbine blade assembly is by secondary air bled through inner and outer walls of primary combustion chamber just ahead of fixed blading. Rear (turbine) bearing cooled by air tapped from fourth stage of compressor and feeding into hollow rotor extension.

Exhaust Pipe.—Sheet steel inner cone and outer casing.

Lubrication.—Eight-feed oil pump. Maximum oil pressure 650 lbs./sq. in. (46 kg./sq. c/m.). Oil mist system for compressor and turbine bearings. No scavenge pump or oil cooler as oil is not re-circulated.

Fuel System.—From filter fuel passes to two mechanically-driven pumps and thence, *via* throttle, isospeedic governor and H.P. cock to fuel manifold and burners. Throttle valve controls engine speed from idling to maximum r.p.m. Governor is an overspeed control for emergency use only. H.P. cock is an on/off control used only for starting and stopping. Tapping from pump delivery taken through solenoid-operated valve and thence to two igniters. This valve operates when boost coils and starter motor switched on. By-pass controlled by barostat allows surplus fuel to return to pump suction.

Starting.—Rotax C.3805 electric starter. Rotor initially accelerated by electric starter while pumps deliver fuel through solenoid to igniters. When burner pressure gauge moves H.P. cock is opened. When rotor reaches 1,800 r.p.m. electric starter is automatically cut out.

Mounting.—Two thrust brackets on compressor outlet branch, either above or below horizontal centre-line. Two pairs of steadying facings at forward end of compressor, either upper or lower pair being used. Alternative steady point at rear flange of combustion chamber.

Auxiliaries.—KDG low-pressure fuel filter, Pesco fuel pump, two Ricardo HR 5 or one HR 7 barostat, Isospeedic governor, Metrovick Mk. 8 throttle valve, Metrovick Mk. 2 H.P. cock, Plessey eight-feed oil pump, and Rotax electric starter. Standard drive provided for Rotol gearbox for aircraft accessories.

Fuel.—Aviation kerosene RDE/F/Ker. Pump delivery pressure 650 lbs./sq. in. (45.7 kg./sq. c/m.). Burner pressure (maximum) 450 lbs./sq. in. (31.6 kg./sq. c/m.) (minimum) 16 lbs./sq. in. (1.12 kg./sq. c/m.).

Dimensions.—Overall length 159 in. (4,040 m/m.), Maximum diameter 37.9 in. (960 m/m.), Nozzle bore 16 in. (410 m/m.).

Weight Dry.—1,750 lbs. (794.5 kg.) without tail-pipe.

Performance.—Maximum take-off or combat thrust (5 min.) 3,500 lbs. (1,590 kg.), Maximum climb thrust (98% r.p.m. and 30 min. limitation) 3,300 lbs. (1,500 kg.), Maximum continuous thrust (95% r.p.m.) 3,000 lbs. (1,362 kg.), Idling thrust 200 lbs. (91 kg.) at 2,500 r.p.m.

THE METROVICK F.5.

The F.5 comprises a gas-generator unit as used on the F.2 Series IV engine and a contra-rotating pusher fan unit, 5 ft. 6 in. (1.67 m.) in diameter, driven by a four-stage turbine. The augmenter is connected with the gas-generator by hot-gas ducting 26 in. (66 m/m.) in diameter and of a length determined by the aircraft installation. In effect, the augmenter serves as a contra-rotating multi-blade propelling unit, additional thrust being supplied from the propelling nozzle behind the turbine.

Take-off power at sea level represents a total of 4,710 lbs. (2,140 kg.), of which 2,840 lbs. (1,290 kg.) is fan thrust and 1,870 lbs. (850 kg.) is jet thrust. The weight of the generator is 1,600 lbs. (726.4 kg.) and the augmenter 600 lbs. (272.4 kg.).

POWER JETS.

POWER JETS (RESEARCH AND DEVELOPMENT), LTD.

Registered Office: 8, Hamilton Place, London, W.1.

Power Jets (Research & Development) Ltd was formed in 1944 as an entirely State-owned organization to acquire the whole voluntarily-sold assets of the foundation Company, Power Jets, Ltd., of which the major shareholding was private. A result of the acquisition of Power Jets by the State was its amalgamation with the Turbine Section of the Royal Aircraft Establishment. The Directors were appointed by the Minister of Aircraft Production. The Company did not engage in production, and had for its object the fostering of the gas turbine industry as a whole, primarily by technical contribution to the science, and to exploit Government-owned rights in inventions, etc.

On July 1, 1946, the main functions of Power Jets (Research and Development) Ltd. were transferred to a new organization known as the National Gas Turbine Establishment, which also took over the Power Jets' establishments at Whetstone, near Leicester, and Pyestock, near Farnborough. Dr. H. Roxbee Cox, Chairman and Managing Director of Power Jets (Research and Development), Ltd., is Director of the new establishment.

The sole function remaining to Power Jets (Research and Development), Ltd. is that of exploiting Government-owned patents in the gas-turbine field.

A review of the pioneer work of Power Jets, Ltd. from 1936 through the war period was given in the last issue of "All the World's Aircraft."

ROLLS-ROYCE.

ROLLS-ROYCE, LTD.

HEAD OFFICE: DERBY.

Assistant Chief Engineer (Gas Turbines): Dr. S. G. Hooker, O.B.E., B.Sc., D.I.C., D.Ph., A.F.R.Ae.S.

It was in 1938 that Rolls-Royce first took an interest in jet-propulsion units for aircraft, and in 1939 the first design projects were made. In 1940 test work was begun on various components; facilities for manufacture at Derby were lent to Power Jets, Ltd., the producers of Air Commodore Whittle's type of jet-propulsion engine; and the machining of such parts as supercharger casings and wheelcase, and the manufacture of turbine blades and all pumps were undertaken.

In June, 1941, a test plant was set up by Rolls-Royce at Derby for development work on compressors. At the end of 1941, under instructions from the Ministry of Aircraft Production, Rolls-Royce undertook the development and manufacture of the Whittle-type engine in conjunction with Power Jets, Ltd. and the Rover Company.

The first Rolls-Royce jet-propulsion engine known as the WR-1 was designed for experimental test purposes, with low turbine blade stresses, i.e., a comparatively big engine for a given thrust. Its diameter was 54 inches (1,376 m/m.) and the design thrust was 2,000 lb. (907 kg.). It only weighed 1,100 lb. (500 kg.) and the first engine ran for some 35 hours. Two of these were built, but trouble was experienced with the combustion equipment, so extensive development work on combustion chambers and turbine blades was carried out.

The restricting factor at the time was the construction of the turbine blades, due to limitations of temperature and r.p.m., but so much progress was made that Rolls-Royce was asked to take over the development and manufacture of the Whittle units.

Meanwhile Rolls-Royce had converted a Vickers Wellington twin-engined bomber into a flying test-bed for the W2B/23 Whittle engine, which was mounted in the tail in place of the gun turret. The instrument panel was mounted forward in the aircraft, with remote control to the engine. Twenty-five hours flying was carried out with the first engine giving 1,250 lb. (565 kg.) thrust. A second Wellington was adapted for high altitude work at 35,000 ft. (10,675 m.) and this aircraft is still flying.

The first Rolls-Royce version of the Whittle W2B/23 jet-propulsion engine passed its 100-hour type test in April, 1943. It was 43 ins. (1,098 m/m.) in diameter and gave a thrust of 1,700 lb. (772 kg.) for a weight of 850 lb. (386 kg.). It was named the Welland, being the first of the Rolls-Royce "River" class of jet-propulsion engines, this name being chosen to give the idea of flow associated with jet-propulsion. Production deliveries of the Welland to the R.A.F. began in May, 1944, when this engine also passed its first 500-hour type test and went into service with 180 hours between overhauls.

Meanwhile the Gloster E.28/39 experimental jet-propelled monoplane was fitted with the Rolls-Royce engine in 1943 and the F9/40, the prototype of the Meteor, was fitted with two Welland engines.

In March, 1942, the Rover Company ran its prototype W2B/26 engine which was based on a Power Jets' design for a "direct-flow" combustion engine. The development of this engine was pursued by the Rover Company until Rolls-Royce took over the Rover factory at Barnoldswick in April, 1943. The W2B/26 served as the prototype for the Derwent I and the first Rolls-Royce engine of this type, completed in three and a half months, was on test in July, 1943. It passed its 100-hour type test at 2,000 lb. (910 kg.) in November, 1943, and in April, 1944, completed its first flight test. This engine was intended as a replacement for the Welland engine in the Gloster Meteor twin-jet fighter. The Meteor first flew with two Series I Derwent engines in March, 1944, each unit developing a thrust of 2,000 lb. (907 kg.) for a weight of 920 lb. (418 kg.).

The satisfactory performance of this new engine gave great promise for further development. A continuous programme, involving many 100-hour tests to a type-test schedule, was carried out, culminating in a successful 500-hour type-test without strip or major replacement of any kind.

The Derwent Series II engine gave a 10% improvement in thrust, delivering 2,200 lb. (1,000 kg.). The Series III was an experimental engine to provide suction on the wing surfaces for boundary layer removal. Series IV gave another 10% increase up to 2,400 lb. (1,090 kg.) thrust; and the Series V Derwent engine, which is fitted in the Gloster Meteor IV, is rated at 3,500 lbs. (1,590 kg.) thrust.

On September 7, 1946, a Gloster Meteor fitted with two Derwent V engines established a World's Speed Record of 616 m.p.h. (991 km.h.), beating the previous record of 608 m.p.h. also achieved by a Derwent-engined Meteor.

The Rolls-Royce Dart is a new turbine-airscrew unit, no details of which were available for publication at the time of closing for press. The Dart will power the new Vickers V.C.2 development of the Viking, to be known as the Viceroy.

In 1946 a licence was granted to Hispano-Suiza for the manufacture of Rolls-Royce gas-turbines in France, and an agreement was concluded with the Taylor Turbine Corpn. for a similar licence in America.

THE ROLLS-ROYCE RB.37 DERWENT V.

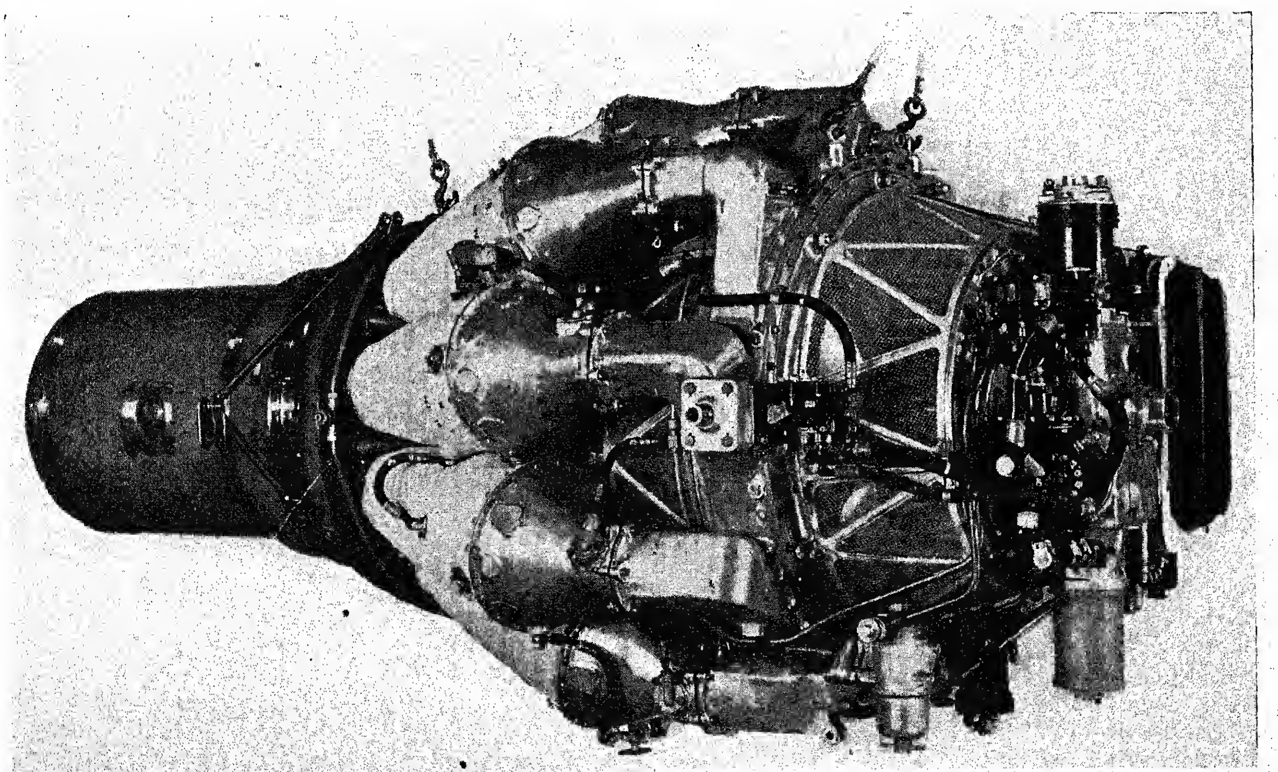
TYPE.—Centrifugal-flow Gas Turbine with single-stage double-entry compressor and single-stage turbine.

COMPRESSOR.—Single-stage double-entry centrifugal compressor with double-sided impeller 20.68 in. (525 mm.) in diameter. A 20-vane diffuser has a throat area of 38 sq. in. (245 sq. cm.) Compression ratio 3.9 : 1 static, at take-off. The compressor is mounted on the forward end of the shaft carrying the single-stage axial-flow turbine. The main shaft is carried on three bearings and is surrounded by the ten combustion chambers.

TURBINE.—Single-stage axial-flow turbine with 54 blades. Direction of rotation anti-clockwise (viewed from rear).

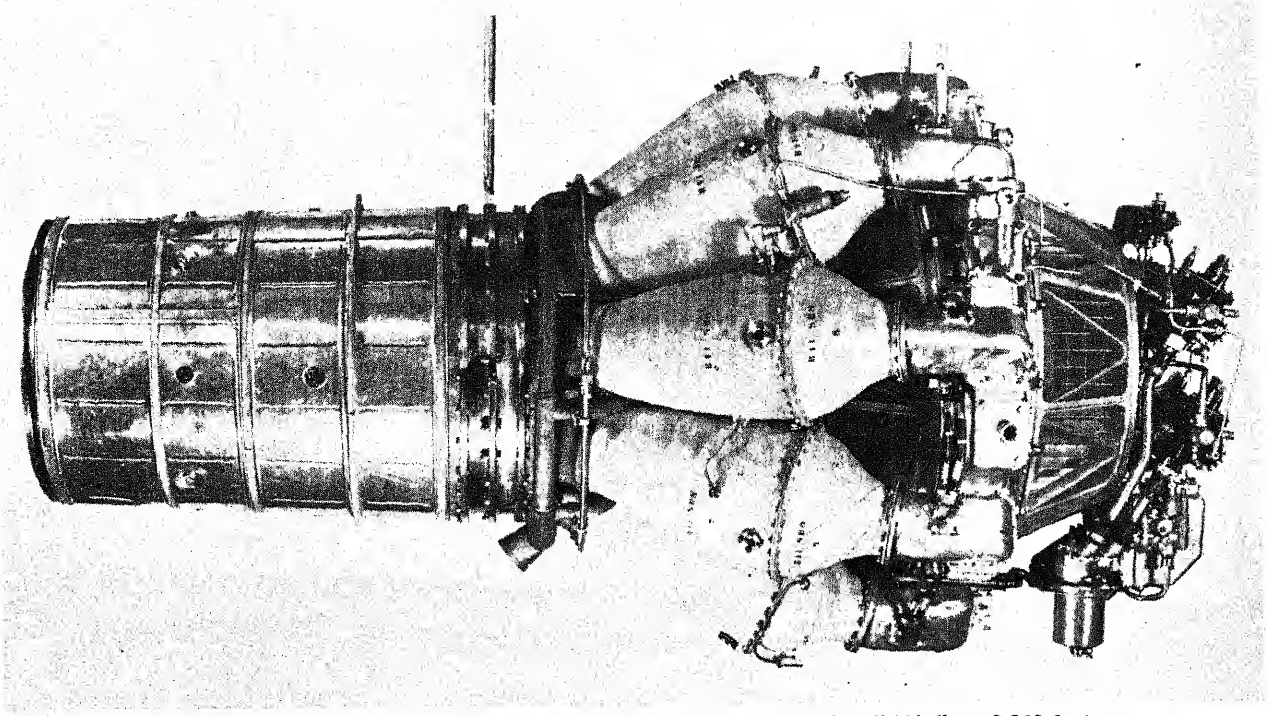
COMBUSTION CHAMBERS.—Nine straight flow-combustion chambers with internal concentrically-mounted domed colander flame tubes. Balance pipes are provided between the chambers to equalise pressure and to allow flames to ignite the fuel in adjoining flame tubes when starting up. Two igniter plugs (in chambers 3 and 8). Combustion is complete before the gases enter the turbine guide vane ring at the rear of the chambers.

FUEL SYSTEM.—An engine-driven positive-displacement multi-plunger swashplate pump, with built-in overspeed governor, draws fuel through a fabric-element low-pressure filter and delivers it to fixed



The Rolls-Royce Derwent V centrifugal-flow Gas Turbine. (Take-off Rating 4,000 lb.=1,814 kg.).

ROLLS-ROYCE—*continued.*



The Rolls-Royce Nene centrifugal-flow Gas Turbine. (Take-off Rating 5,000 lbs.=2,266 kg.).

orifice type burners, one in each combustion chamber, via a throttle control valve and ring manifold. The pump delivery pressure is controlled by a barostat relief valve, with setting dependent on atmospheric pressure, excess fuel from the barostat being delivered directly back to the aircraft tank. A combined shut-off cock accumulator and dump valve unit is fitted at the lowest point (inlet) of the fuel manifold, for stopping the engine. The accumulator supplies a metered quantity of fuel, at controlled pressure, to the burners during the starting cycle. The dump valve spills unwanted fuel to the atmosphere when the engine is being stopped and prevents the combustion chambers becoming flooded.

FUEL.—Aviation Kerosene (paraffin) to which has been added 1% of lubricating oil.

LUBRICATION SYSTEM.—The oil tank (22 pints=12.5 litres capacity) is mounted on the engine wheelcase and its internal construction allows 15 seconds inverted flight without interruption of oil supply. The nominal oil circulation rate at maximum r.p.m. is 215 Imp. gallons (976 litres) per hour (minimum) and the nominal flow rates to front, centre and rear main bearings are 30, 50 and 70 gallons (136,227 and 318 litres) per hour respectively. A gear-pump supplies pressure oil to the main bearings and wheel-case. The front bearings drain into the wheel-case, which is scavenged by the upper unit of a twin gear-type scavenge pump. The lower unit scavenges directly the centre and rear main bearings. The combined delivery from the twin scavenge pump is discharged into the tank, via an oil cooler, which is mounted on the engine compressor casing.

ACCESSORIES.—Engine accessories, including fuel and oil pumps, generator and accessory gear-boxes, are mounted on the wheelcase at the front of the engine, together with an electric starter motor.

MOUNTING.—Two trunnions are mounted on the horizontal centre-line of the compressor casing, and a torsionally-free diamond frame with link connections and two aircraft pick-up points is located 40 in. (1,006 mm.) aft of the two main trunnions.

HOUSING.—The whole engine is housed in a streamline cowling which has a large air intake in front and a projecting jet-pipe or propelling nozzle at the rear.

DIMENSIONS.—Maximum diameter 43 in. (1,092 m/m.), Overall length 88.5 in. (2,248 m/m.), Frontal area 10.1 sq. ft. (0.94 sq. m.).

WEIGHT DRY (Including tank and oil cooler).—1,250 lbs. (567 kg.).

PERFORMANCE.—Take-off rating 4,000 lbs. (1,814 kg.) thrust at 15,000 r.p.m. at sea level, Normal rating 3,500 lbs. (1,588 kg.) thrust at 14,600 r.p.m. at sea level, Cruising rating 3,000 lbs. (1,360 kg.) thrust at 14,000 r.p.m. at sea level, Idling rating 120 lbs. (54 kg.) thrust at 5,500 r.p.m.

CONSUMPTIONS.—Fuel consumption (cruising) 1.02 lb./lb. thrust/hr. (1.02 kg./kg. thrust/hr.), Oil consumption 0.0004 lb./lb. thrust/hr. (0.4 grammes/kg. thrust/hr.).

THE ROLLS-ROYCE RB.39 CLYDE.

The Clyde is a propeller turbine unit which incorporates a nine-stage axial compressor, a single-stage centrifugal compressor and two turbines, the forward high-pressure turbine driving the centrifugal blower and the rear low-pressure turbine the axial flow compressor and the contra-rotating airscrews.

The Clyde has a rating of 3,000 shaft h.p. plus 1,200 lbs. (545 kg.) static jet thrust at 6,000 r.p.m. The dry weight without airscrews is 2,500 lbs. (1,135 kg.).

THE ROLLS-ROYCE RB.41 NENE.

The Nene, a parallel development of the Derwent which it resembles in general features and layout, was designed and built in 5½ months and was first run in October, 1944. This engine has flown in the Lockheed P-80 Shooting Star and the D.H. Vampire. It is also earmarked for a number of aircraft specially designed to take advantage of the enormous thrust available from this new power-plant.

Designed early in 1944 for a static thrust of 4,000 lbs. (1,814 kg.) at 12,300 r.p.m., performance was later improved and cleared for flight at 5,000 lbs. (2,266 kg.) at 12,300 r.p.m.

TYPE.—Centrifugal-flow gas turbine with single-stage double-entry compressor and single-stage turbine.

COMPRESSOR.—Single-stage double-entry centrifugal compressor with double-sided impeller. Impeller has 29 vanes per side with separate forged aluminium rotating guide vanes machined all over. Compression ratio (static) 4 : 1. Rotor assembly consisting of impeller turbine and shafts is supported on three bearings. End bearings of roller type and centre bearing a deep-grooved ball bearing to take shaft thrust loads. Just aft of centre bearing a spherical coupling transmits axial thrust to turbine rotor shaft and thus to centre bearing which transmits the torque. Also mounted on shaft between compressor and centre bearing is a fan which directs cooling air on to and under centre and rear bearings and face of turbine disc.

TURBINE.—Single-stage axial flow turbine comprising solid steel disc and 54 blades in Nymonic 80 steel. Roots of blades are broached to form tapered serrations which mate with similar broachings in periphery of turbine disc. At centre of turbine disc an integral flange serrated at its circumference is provided for coupling turbine wheel to corresponding serrations on flange of turbine shaft. Wheel and shaft spigoted together and secured by bolts through flanges. Mean blade speed 1,070 ft./sec. (326.3 m./sec.). Turbine wheel temperature 800°C. Jet pipe temperature 700°C.

COMBUSTION CHAMBERS.—Nine equally-spaced straight-flow combustion chambers converging into discharge nozzle. Each chamber consists of outer casing, a perforated flame tube and duplex burner, rear end of each chamber locating freely in discharge nozzle box to permit differential expansion. A slight taper fit inside nozzle box ensures gas-tight joint when engine warms up. Flame igniters in Nos. 3 and 8 air casings. Flame igniter consists of a small atomiser embodied in one unit with igniter plug. Atomiser is fed with fuel from low-pressure side of fuel system and is controlled by solenoid-operated valve which draws current from low-tension side of ignition system. On start-up solenoid is energised at same time as igniter plug, allowing fuel to pass to atomiser and to be discharged in form of easily ignitable spray. High-tension spark from igniter plug lights spray, flame of which in turn lights spray of fuel from pilot atomiser of duplex burner. Flame spreads to other chambers through interconnecting pipes between all chambers. An automatic "time" control cuts out ignition system and solenoid-operated valve closed by light spring which cuts off fuel supply to igniter plug. By this time engine is running under conditions of continuous combustion.

FUEL SYSTEM.—Twin pumps of oscillating multi-plunger type with built-in overspeed governors draw fuel through filter mounted under wheelcase and deliver to burners via throttle control valve, high-pressure shut-off cock and pressurising valve. Barometric pressure control acts on servo mechanism in high-pressure pump to vary pump delivery according to altitude requirements.

FUEL.—Aviation Kerosene (RDEF/F/KER) plus 1% oil.

LUBRICATION.—Wet sump system, with main bulk of oil contained in sump formed by lower part of wheel case. Sump houses pressure and scavenge oil-pumps, two gauze scavenge-oil filters, Puralator

ROLLS-ROYCE—*continued.*

high-pressure filter, pressure relief valve and de-aerator. H.P. filtered oil passed to wheelcase to feed bearings of rotor shaft. Oil jets at critical points, in conjunction with restrictors, supply controlled quantity of oil to bearings. Scavenge oil from front bearing and wheelcase drains freely into sump, while that from rear bearing passes to centre bearing housing and then from both bearings to scavenge pump via sump base and gauze strainers. Capacity of oil sump 10 pints (5.7 litres).

Exhaust Assembly.—Consists of exhaust cone, jet pipe and nozzle. Exhaust cone of fixed length but jet pipe varies in length according to installation requirements of aircraft. These parts mainly double-walled, with space between packed with Alfol heat-insulating material. Air heating jackets can be arranged around jet pipe for gun or cabin heating.

Accessories.—Wheelcase on front of engine, driven from forward impeller shaft, houses drives for aircraft accessory gear-box, tachometer generator and twin fuel-pumps. Three alternative drive positions for aircraft accessory gear-box, upper and lower horizontal drives and upward inclined drive, all facing forward and suiting Rotol S.G.1 series of gear-boxes. Speed of gear-box drives 0.41 engine speed. Cabin supercharger driven from accessory gear-box. 24-volt electric starter motor mounted on port side of wheelcase.

Mounting.—Range of standardised brackets designed to suit various types of installation with six alternative combinations of attachment points.

Dimensions.—Maximum diameter 49.5 in. (1,258 m/m.), Overall length to exhaust cone flange 96.8 in. (2,960 m/m.), Length less exhaust cone 63.9 in. (1,624 m/m.), Length of jet pipe, to suit installation, Frontal area 13.4 sq. ft. (1.24 sq. m.).

Weight.—Dry (including auxiliaries but excluding aircraft accessories and jet pipe) 1,550-1,600 lbs. (704-726 kg.).

Performance.—Take-off, Combat and Maximum Climb thrust rating 5,000 lbs. (2,266 kg.) at 0 m.p.h., 4,620 lbs. (2,097 kg.) at 200 m.p.h. (321 km.h.), 4,390 lbs. (1,993 kg.) at 400 m.p.h. (644 km.h.), 4,450 lbs. (2,020 kg.) at 600 m.p.h. (966 km.h.) at 12,300 r.p.m. all at sea level, Cruise thrust rating 3,620 lbs. (1,643 kg.) at 100 m.p.h. (161 km.h.), 3,220 lbs. (1,462 kg.) at 300 m.p.h. (483 km.h.), 3,070 lbs. (1,404 kg.) at 500 m.p.h. (805 km.h.) all at 11,500 r.p.m. at sea level.

Consumptions.—Fuel consumption 1.06 lb./lb. thrust/hr. (1.06 kg./kg. thrust/hr., Oil consumption 0.0003 lb./lb. thrust/hr. (0.3 grammes/kg. thrust/hr.).

THE ROLLS-ROYCE RB.50 TRENT.

The Trent is an adaptation of the Derwent arranged to drive a five-blade airscrew and was evolved to gain experience with a unit combining jet and airscrew propulsion. Experimental work on this engine began in May, 1944, and in September, 1945, two Trent units were flown for the first time in a Gloster Meteor. The Trent develops 1,250 lbs. (570 kg.) thrust and 750 shaft horse-power.

INTERNAL COMBUSTION ENGINES

A.B.C.

A.B.C. MOTORS, LTD.

Head Office and Works: Walton-on-Thames.

Established: 1910.

Managing Director: T. A. Dennis.

The first A.B.C. aircraft engines were produced in 1911 and were of the vertical and vee water-cooled types. During the War 1914-18 the firm was responsible for the design of the A.B.C. Wasp and Dragonfly seven and nine-cylinder radials of 180 and 350 h.p. respectively, the first serious attempt to produce high-powered engines of this type.

In the inter-war period the company produced a series of horizontally-opposed air-cooled engines, of which the 34 h.p. Scorpion two-cylinder and the 75 h.p. Hornet four-cylinder engines were typical.

For some years the company has, at the request of the Air Ministry, been engaged in the development of auxiliary power-units. The latest units of this type are described below.

THE A.B.C. TYPE II AUXILIARY POWER-UNIT.

The A.B.C. Auxiliary Power-Unit, Type II, comprises a horizontally-opposed twin-cylinder air-cooled four-stroke engine, driving a dynamotor and a gear-box by which the drive may be engaged with a re-fuelling pump, bilge-pump, and two air-compressors.

The unit is designed for installation in flying-boats, the generator being employed to maintain the accumulators in a charged condition, the re-fuelling pump to replenish the fuel tanks from an outside source of supply, the bilge-pump to remove any bilge water that may accumulate in the hull or floats, and the air-compressors to charge air-bottles for use with a gas-starter.

The unit is fitted with a pulley starter, but the engine may also be started electrically by means of the dynamotor. The fuel supply may be taken from the main tanks, or from an independant source of supply, while the oil supplies for both the engine and pumps are contained in the base of the unit. Each cylinder of the engine is cooled by a fan, which blows air through a duct to a cowl covering the cylinder and cylinder-head fins. The unit may thus be installed in flying-boats fitted with air-cooled or liquid-cooled engines.

The engine is of the horizontally-opposed type and uses a three-throw crankshaft, which entirely avoids the rocking couple so prevalent in normally designed horizontally-opposed engines.

The engine speed is controlled within specified limits by a governor of the centrifugal type.

SPECIFICATION.

Engine.—Bore 54 m/m. (2.1 in.), Stroke 38 m/m. (1.5 in.), Capacity 174 c.c., Compression ratio 7 : 1, Normal output 5 h.p. at 4,000 r.p.m., Carburettor Zenith type 24UH (modified), Magneto B.T.H type MC.2.S1.

Dynamotor.—A.M. type 5U/824, output 12 volts, 350 watts, or A.M. type 5U/784, output 24 volts, 350 watts. A 24-volt 1,000-watt dynamotor is also available.

Air Compressors.—B.T.H. type AW.1A or 1B. The two compressors together are capable of charging air-bottles of 400 cub. in. (11.3 cub. m.) capacity to pressure of 200 lbs./sq. in. (14 kg./sq. c/m.) in 2.5 min.

Refuelling Pump.—Eccentric rotor and vane type. 2,500 Imp. gallons (11,365 litres) per hour with suction lift of 16 ft. (4.8 m.) and discharge head of 10 ft. (3.05 m.) through 1½ in. (3.8 c/m.) diameter pipes. Relief valves set for 30 lbs./sq. in. (2.1 kg./sq. c/m.).

Bilge Pump.—Eccentric rotor and vane type. 3,000 Imp. gallons. (13,650 litres) per hour with suction lift of 16 ft. (4.8 m.) through 1½ in. (3.8 c/m.) diameter pipes.

Weights.—Complete unit with auxiliaries 146 lbs. (66.3 kg.), Weight of engine with bedplate 60 lbs. (27.2 kg.).

THE A.B.C. TYPE 10 AUXILIARY POWER-UNIT.

To meet the requirements for increased electrical output up to 15 K.V.A., the company has produced a larger engine, of which the following are brief particulars:

Engine.—Bore 63.5 m/m. (2.5 in.), Stroke 76.2 m/m. (3 in.), Capacity 1,000 c.c., Compression ratio 7 : 1, Normal output 25 h.p. at 4,000 r.p.m., Estimated weight of engine 100 lbs. (45.4 kg.).

The engine is a four-cylinder horizontally-opposed unit with crankcase and cylinder blocks of Electron, the cylinders having inserted cast-iron liners. The cylinder heads are in aluminium, the spherical combustion chambers having 90° valves operated by push-rods and rockers. The duralumin one-piece connecting-rods operated on a built-up two-throw crankshaft. All primary and secondary forces and couples are balanced by a special device.

ALVIS.

ALVIS LTD.

Head Office and Works: Coventry.

Directors: A. E. Nicholson, J.P. (Chairman), J. J. Parkes (Managing Director), Capt. G. Smith-Clarke, M.I.Mech.E., M.I.A.E., M.S.A.E., A.F.R.Ae.S., M.S.I.A. (Chief Engineer), S. W. Horsfield, Lieut-Col. J. C. Chaytor, R. W. Rutledge and Capt. H. S. Harrison-Wallace, D.S.O., R.N. (Retd).

Alvis Limited, who are pioneers in the production of high-class motor cars, entered the aero-engine industry towards the end of 1935.

Its first products were the 1,060 h.p. Pelides fourteen-cylinder two-row radial, the Pelides-Major supercharged for medium and high-altitude respectively, and the 450 h.p. Leonides nine-cylinder radial supercharged for medium altitude. Both the Pelides and Leonides passed the British Air Ministry Civil Type Test before the war.

During the war the Alvis company was mainly engaged in the production of major assemblies for Rolls-Royce aero-engines and the overhaul and repair of complete engines and power-plants.

It has now resumed the development and production of the Leonides engine. The first commercial installations will be in the Cunliffe-Owen Concordia and the Percival Prince.

THE ALVIS LEONIDES.

The first Leonides design was type-tested and test flown in 1929 but development was interrupted by the war.

In 1944 a development contract was officially placed with the Alvis company for the new series Leonides and the engine passed the official 112-hour acceptance test for military engines in November, 1945.

The new Series engines are known by the designations L.E.1.M. and L.E.2.M., the latter differing from the former by being provided with shaft drive for a remote accessory gear-box and a reduction gear ratio of 0.625 instead of 0.5 : 1.

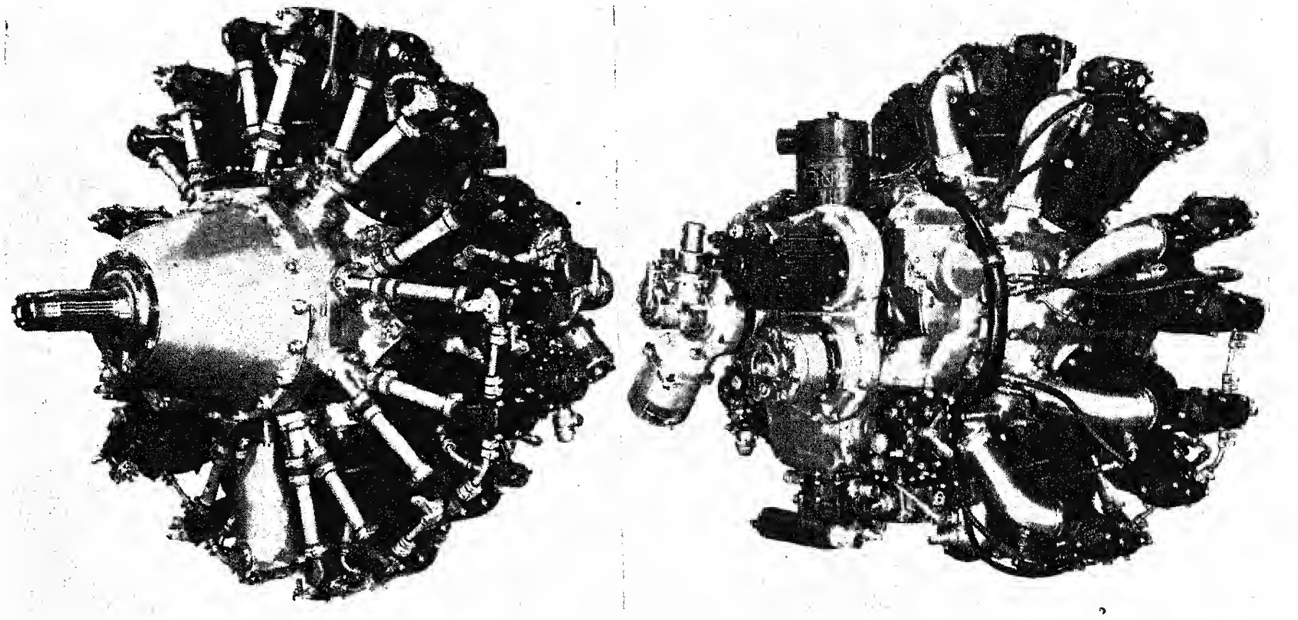
Type.—Nine-cylinder radial air-cooled, geared and supercharged.

Cylinders.—Bore 4.8 in. (122 m/m.), Stroke 4.41 in. (112 m/m.), Capacity 718.5 cub. in. (11.78 litres), Compression ratio 6.8 : 1. Nitrided steel barrels and cast Y-alloy heads screwed and shrunk on. Both barrels and heads have close-pitch fins. Cylinders attached to crankcase by studs.

Pistons.—Forged aluminium-alloy with internal finning below crown.

Valve Gear.—Two inclined valves per cylinder with independent rocker system completely enclosed. Both valves of austenitic

***ALVIS**—continued.*



Two views of the 500 h.p. Alvis Leonides nine-cylinder radial engine.

steel, the exhaust valve sodium-cooled and with "bright-ray" covered heads and seats. Two-track cam disc, each track with four cams. Roller-type cam followers positively lubricated and pressure oil passes up hollow push-rods to rockers.

Connecting Rods.—I-section master-rod and eight I-section auxiliary-rods machined from high-grade steel.

Crankshaft.—Alvis patent single-throw shaft with divided crank-pin. The divided pin is splined internally for a mating and splined steel coupling. Externally a white-metaled steel bearing sleeve is slipped on and the whole assembly is bolted up end to end and secured by locking-ring. Shaft runs in uncaged roller bearings and one ball thrust bearing.

Carburation.—Hobson CHA 48150 Mk. I automatic low-pressure fuel injector. Induction system incorporates air-cleaning and de-frosting with oil-heated throttles and throttle housing.

Supercharger.—Atomised mixture fed into eye of impeller of centrifugal supercharger. Supercharger ratio 6.5 :1.

Ignition.—Two B.T.H. type C.25E.95 or C.9A/2 magnetos with fully screened ignition system. Two plugs per cylinder.

Lubrication.—Dry sump system. One pressure pump and two scavenge pumps in tandem. Normal oil pressure 60-80 lbs./sq. in. (4.2-5.6 kg./sq. c/m.), Inlet temperature (max.) 80°C., Output temperature (max.) 110°C., Normal oil flow 300 gals. (1,365 litres) per hour.

Reduction Gear.—Farman type epicyclic gear, with three satellite bevel pinions mounted on lead-bronze bearings and a large-diameter thrust ball-bearing in the driving bevel wheel on front end of crankshaft. Gear ratio 0.5 or 0.625 : 1.

Airscrew Shaft.—No 3 size, L.H. rotation. Constant-speed governor unit driven through bevels mounted on front of cam gearing drive-shaft. Operating oil passes through annular channels and drillings in special oil transfer unit located inside stationary bevel of reduction gear.

Accessories.—On L.E.1.M. detachable gear case on back cover. Provision for air compressor, high-pressure hydraulic pump vacuum pump, generator and starter motor. L.E.2.M has provision for auxiliary drive gear-box mounted on aircraft bulkhead. 12 or 24-volt electrical system. Accessory drive gear taken from engine tail shaft.

Mounting.—Dynafocal flexible type with four pin-jointed attachments.

Cooling.—Complete pressure baffling and flexibly-mounted close-fitting cowling with hinged panels and electrically-operated gills.

Starting.—Rotax type C.0216 hand/electric starter.

Fuel.—100 Octane (5 c.c. TEL). Type test rating obtained on 87 octane.

Dimensions.—Overall diameter 41.5 in. (1,054 m/m.), Overall length (with accessories) 52.8 in. (1,353 m/m.).

Weights Dry.—Engine 742 lbs. (336.8 kg.), Complete power-plant 1,150 lbs. (522 kg.).

Performance.—Take-off output 500 h.p. at 3,000 r.p.m. (+6½ lbs./sq. in.=0.457 kg./sq. c/m.) boost, Maximum rating 515 h.p. at 4,000 r.p.m. (+6½ lbs./sq. in.=0.457 kg./sq. c/m. boost) at 4,000 ft. (1,220 m.), International rating 425 h.p. at 2,900 r.p.m. (+3 lbs. boost) at 9,000 ft. (2,745 m.), Maximum continuous cruise 400 h.p. at 2,800 r.p.m. (+2 lbs./sq. in.=0.14 kg./sq. c/m. boost) at 10,000 ft. (3,050 m.), Weak mixture cruise 340 h.p. at 2,600 r.p.m. at 11,000 ft. (3,355 m.).

Fuel Consumptions.—Take-off and maximum power 0.68-0.75 pints (0.38-0.43 litres) per h.p./hr., International rating 0.6-0.66 pints (0.34-0.37 litres) per h.p./hr., Maximum continuous cruise 0.58-0.62 pints (0.33-0.35 litres) per h.p./hr., Weak mixture cruise 0.49-0.51 pints (0.28-0.29 litres) per h.p./hr.

ARMSTRONG SIDDELEY.

ARMSTRONG SIDDELEY MOTORS, LTD.

Head Office and Works: Coventry.

Directors: Sir Frank Spencer Spriggs, Hon. F.R.Ae.S. (Chairman), T. O. M. Sopwith, C.B.E., F.R.Ae.S., H. T. Chapman (General Manager) and The Hon. C. D. Siddeley.

Secretary: W. T. Johnson.

This Company, which forms part of the Hawker Siddeley Group, has over a period of years produced a comprehensive range of air-cooled aero-engines ranging in output from 85 to over 1,000 h.p.

During the war the company concentrated on the development and large-scale production of the Cheetah range, which has powered the majority of aircraft used in the advanced training of thousands of R.A.F. and R.C.A.F. aircrews in England and overseas. Over 35,000 Cheetah engines were built up to the end of the war in Europe and during these years the output of the Cheetah was increased from 375 h.p. to 475 h.p.

In spite of the arduous conditions imposed on engines used in training aircraft, the Cheetah was the first engine of its type to be approved by the Air Ministry to run 1,200 hours between overhauls, which put it in the forefront of its class for reliability and low operational costs.

The latest Armstrong Siddeley piston engine is the Cougar, the first nine-cylinder single-row radial to be produced by the company. It is intended for use in medium-sized transport aircraft and advanced trainers. For details of the Armstrong Siddeley A.S.X., Python and Mamba gas turbine engines see pages 3-5d.

THE ARMSTRONG SIDDELEY COUGAR.

Type.—Nine-cylinder radial, air-cooled, geared and moderately-supercharged.

Cylinders.—Bore and Stroke 5.5 in. (140 m/m.), Capacity 1,176 cub. in. (19.28 litres). Steel barrels shrunk and screwed into aluminium-alloy heads and secured to crankcase by sixteen studs.

Valve Gear.—Two valves per cylinder, exhaust valve sodium-cooled. Two-track cam-drum (four cams on each track) running at one-eighth crankshaft speed and in opposite direction actuates automatically-adjustable tappets through push-rods and rockers. Whole valve-gear totally enclosed.

Crankcase.—One-piece aluminium-alloy casting closed at each end by diaphragm plates which carry front and rear roller journal bearings and crankshaft.

Crankshaft.—Split maneton-type shaft.

Connecting Rods.—Master-rod is a hardened steel stamping to which eight auxiliary rods are hinged by plain anchor-pins secured by circlips at each end. Pressure-oil fed through the hollow crankshaft lubricates the white-metal one-piece big-end bearing and the anchor-pin bushes in the auxiliary rods. Floating steel balance weights are attached to each crankshaft web and act as vibration dampers.

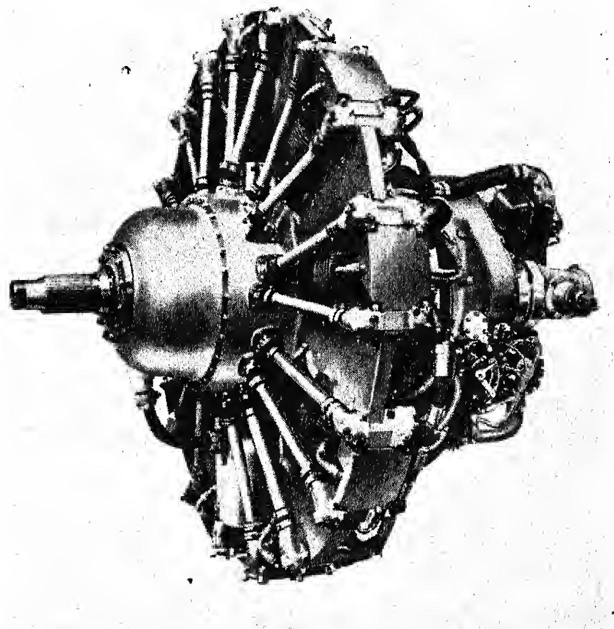
Ignition.—Two B.T.H. or Rotax magnetos. Breeze ignition harness.

Induction.—R.A.E.-Hobson fuel-injection and metering unit is fully-automatic and corrects for boost-pressure, altitude, exhaust back pressure and temperature. It also embodies a fuel pump and fuel cut-off. Fuel fed direct to centre of supercharger rotor. Boost control acts through bell-crank levers on twin throttles. Both throttles and throttle-box are all heated.

Supercharger.—Driven at 8.17 times engine speed through a spring-drive and centrifugal clutch.

Airscrew Drive.—L.H. tractor. Standard No. 4 airscrew shaft. Epicyclic reduction gear ratio 0.589 : 1. Rotol constant-speed unit.

ARMSTRONG SIDDELEY—*continued.*



The 850 h.p. Armstrong Siddeley Cougar engine.

Connecting Rods.—One master rod and six auxiliary rods are air-hardened steel stampings. Master-rod lined with lead-bronze and held on crankpin by four bolts, which also position four grooved anchor pins securing four auxiliary rods. Other two auxiliary rods secured by plain anchor pins pressed into master-rod caps and located by circlips. Auxiliary rods and gudgeon pin end of master rod have fixed bronze bushes.

Crankshaft.—One-piece single-throw steel forging, with pendulum type damper fitted to each crank-web.

Crankcase.—Hiduminium R.R.50 casting or forging of barrel type, consisting of front cover, main case, induction case and rear cover. Rear cover carries magnetos and auxiliaries.

Supercharger.—Unit-mounted on rear crankcase flange. Impeller driven at 6.52 times crankshaft speed through spring-drive and

Starter.—Rotax hand/electric. 24-volt.

Accessories.—Drive provided for Rotol remote accessories box, Type ADE 11, having drives for generator, fuel-pump, air-compressor, hydraulic pump and cabin supercharger.

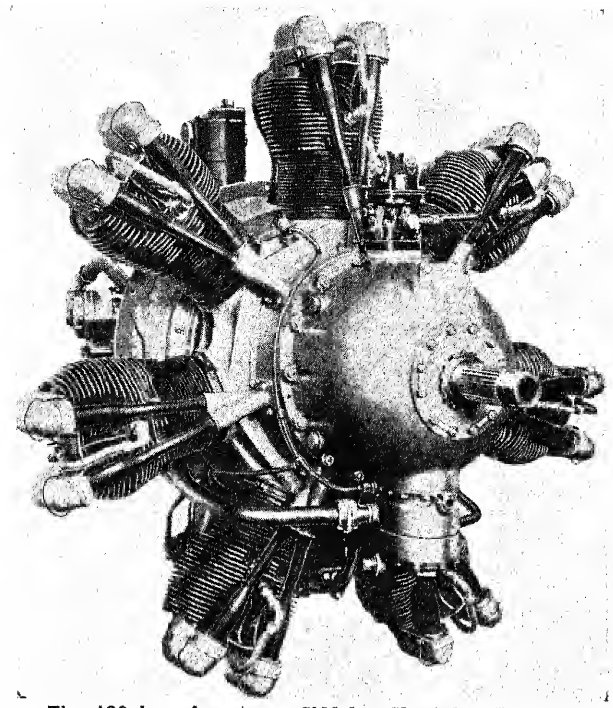
Dimensions, Weights and Performance.—See Table.

THE ARMSTRONG SIDDELEY CHEETAH.

Type.—Seven-cylinder air-cooled radial.

Cylinders.—Bore 5.25 in. (133 m/m.), Stroke 5.5 in. (140 m/m.), Compression ratio 6.35 : 1. Swept volume 834 cub. in. (13.65 litres). Barrel machined from steel forging. Forged aluminium-alloy head shrunk and locked in position.

Pistons.—One compression ring nearest crown, two 1° angle rings above gudgeon pin and double scraper ring nearest skirt. Fully-floating gudgeon pins retained in position by circlips.



The 420 h.p. Armstrong Siddeley Cheetah XV engine.

ARMSTRONG SIDDELEY RADIAL AIR-COOLED ENGINES

Engine	Bore and Stroke	Swept Volume	Take-off Power	International Rating	Maximum Power (combat) Rating	Weight Dry (nett)	Reduction Gear ratio	Dimensions Diameter	Dimensions Length	Fuel Octane No.	Remarks
Cheetah IX	5.25 in. × 5.5 in. (133 m/m. × 140 m/m.)	834 cu. in. (13.66 litres)	410 h.p. at 2,300 r.p.m.	380 h.p. at 2,300 r.p.m. at 4,000 ft. (1,220 m.)	380/395 h.p. at 2,425 r.p.m. at 4,250 ft. (1,300 m.)	700 lb. (317.8 kg.)	Direct	47.7 in. (1,210 m/m.)	47.4 in. (1,204 m/m.)	87	Direct-drive. Fixed-pitch Fairey-Reed metal airscrew. Hand starter.
Cheetah X	5.25 in. × 5.5 in. (133 m/m. × 140 m/m.)	834 cu. in. (13.66 litres)	410 h.p. at 2,300 r.p.m.	380 h.p. at 2,300 r.p.m. at 4,000 ft. (1,220 m.)	380/395 h.p. at 2,425 r p.m. at 4,250 ft. (1,300 m.)	720 lb. (326.8 kg.)	Direct	47.7 in. (1,210 m/m.)	47.4 in. (1,204 m/m.)	87	Fixed-pitch Fairey-Reed metal or Cheetah-type wood airscrew. Rotax hand/ electric starter.
Cheetah XIX	5.25 in. × 5.5 in. (133 m/m. × 140 m/m.)	834 cu. in. (13.66 litres)	410 h.p. at 2,300 r.p.m.	380 h.p. at 2,300 r.p.m. at 4,000 ft. (1,220 m.)	380/395 h.p. at 2,425 r.p.m. at 4,250 ft. (1,300 m.)	705 lb. (320 kg.)	Direct	47.7 in. (1,210 m/m.)	47.4 in. (1,204 m/m.)	87	Fixed-pitch Fairey-Reed metal airscrew. Hand starter.
Cheetah XV	5.25 in. × 5.5 in. (133 m/m. × 140 m/m.)	834 cu. in. (13.66 litres)	420 h.p. at 2,550 r.p.m	385 h.p. at 2,300 r.p.m. at 3,500 ft. (1,070 m.)	390/405 h.p. at 2,425 r.p.m. at 4,000 ft. (1,220 m.)	805 lb. (365.5 kg.)	.732 : 1	47.7 in. (1,210 m/m.)	49.6 in. (1,260 m/m.)	87	With airscrew reduction gear. Rotal constant speed airscrew. Rotax hand electric starter.
Cheetah 25	5.25 in. × 5.5 in. (133 m/m. × 140 m/m.)	834 cu. in. (13.66 litres)	475 h.p. at 2,700 r.p.m. (+4 lb. boost)	385 h.p. at 2,300 r.p.m. at 3,500 ft. (1,070 m.)	390/405 h.p. at 2,425 r.p.m. at 4,000 ft. (1,220 m.)	805 lb. (365.5 kg.)	.732 : 1	47.7 in. (1,210 m/m.)	49.6 in. (1,260 m/m.)	87	Higher take-off rating at + lb. boost. Rotol c/s airscrew.
Cheetah 26	5.25 in. × 5.5 in. (133 m/m. × 140 m/m.)	834 cu. in. (13.66 litres)	475 h.p. at 2,700 r.p.m. (+ 4 lb. boost)	385 h.p. at 2,300 r.p.m. at 3,500 ft. (1,070 m.)	390/405 h.p. at 2,425 r.p.m. at 4,000 ft. (1,220 m.)	805 lb. (365.5 kg.)	.6 : 1	47.7 in. (1,210 m/m.)	49.6 in. (1,260 m/m.)	87	Different reduction gear ratio. Rotol c/s airscrew.
Cougar	5.5 in. × 5.5 in. (140 m/m. × 140 m/m.)	1,176 cu. in. (19.28 litres)	850 h.p. at 2,800 r.p.m. (+ 10 lb. boost)	690 h.p. at 2,500 r.p.m. at 6,000 ft. (1,830 m.)	730 h.p. at 2,700 r.p.m. at 7,500 ft. (2,290 m.)	1,020 lb. (463 kg.)	.589 : 1	48.5 in. (1,232 m/m.)	51.5 in. (1,312 m/m.)	—	Rotol 3-blade c/s full-feathering airscrew.

ARMSTRONG SIDDELEY—*continued.*

centrifugal clutch gears mounted on diaphragm plate on rear of crankcase.

Valve Gear.—Fully-enclosed. One inlet and one sodium-cooled exhaust valve per cylinder. Valve-seats, of nickel-chrome-manganese steel with exhaust seat stellited on face, shrunk and screwed into head. Compensated rocket brackets on heads.

Carburation.—One Claudel-Hobson A.V. 70ME. master-control carburettor incorporating delayed-action acceleration pump, variable datum boost and mixture controls and slow-running cut-out. Hot oil circulates around chokes.

Ignition.—Completely screened ignition system. Two B.T.H. SC7-2 magnetos mounted at 40 degrees on rear cover. Vernier adjustment for timing of each magneto incorporated on drives.

Lubrication.—Two-stage pump mounted on reduction-gear casing incorporating pressure relief valve and filter of the fine mesh disc type. Crankcase oil jet supplies additional oil for cold starting.

Accessory Drives.—Provision for 750-watt generator, hydraulic pump, air compressor and vacuum pump on auxiliary-drive box mounted on rear cover, which also incorporates two diaphragm fuel pumps.

Dimensions, Weights and Performance.—See Table.

BRISTOL.

THE BRISTOL AEROPLANE CO., LTD.

Head Office and Works: Filton, Bristol.

London Office: 6, Arlington Street, St. James's, S.W.1.

Directors: W. G. Verdon Smith, C.B.E., J.P., (Chairman); Sir G. Stanley White, Bt., (Managing Director); H. J. Thomas, (Assistant Managing Director); George S. White; N. R. Rowbotham, C.B.E., B.Sc. and K. J. G. Bartlett (Sales Director).

Chief Engineer (Piston engines): R. Ninnes.

The Bristol Aeroplane Co., Ltd. was originally founded in 1910 but it did not enter the aero-engine field until 1920, when an Aero-engine Department was established to design and manufacture radial air-cooled engines.

Its first engine was the famous Jupiter nine-cylinder radial which quickly established for the company a world-wide reputation. It was used in all types of military and civil aircraft and was built under licence in almost every country possessing suitable manufacturing facilities.

The Jupiter, a nine-cylinder air-cooled radial with compensated rocker mechanism, was developed through a long series. The Jupiter VII was the first model with mechanically driven supercharger and the Jupiter VIII the first model with reduction gear. The Jupiter was the first air-cooled engine to pass the Air Ministry full-throttle test, the first to employ automatic boost control and the first to be installed in air-liners. The Jupiter captured the World's Height Record in 1929.

The Jupiter was followed in 1927 by the Mercury and in 1932 by the Pegasus. The Mercury, developed for fighter aircraft, was similar to the supercharged Jupiter but was fitted with a reduction gear and had a shorter stroke. It was the first British aero-engine to be approved for controllable-pitch airscrews.

The Pegasus was also a development of the Jupiter. It progressed through many series, all fitted with superchargers and reduction gears. The Pegasus XVIII was the first Bristol engine to be fitted with a two-speed single-stage supercharger. The Pegasus gained three Height Records (1932-1936-1937), it was used for the first flight over Mt. Everest (1933) and attained the World's Long-Distance Record in 1938. The latest models have an output of over 1,000 h.p. as compared with the 450 h.p. of the original Jupiter of the same capacity. Pegasus and Perseus engines are the standard power units in the four-engined flying-boat fleet of the British Overseas Airways Corporation.

Concurrently with the steady development of poppet-valve engines, the Bristol company began research in 1926 with sleeve-valves and the first complete Bristol sleeve-valve engine—the Perseus was built in 1932. The Perseus was followed by the Aquila, Taurus, Hercules and Centaurus and development still proceeds. The Hercules has been in large scale production not only by the parent Company but also in various shadow factories, some operated under Bristol supervision.

The Perseus, a nine-cylinder radial with single-speed supercharger and reduction gear, initiated the use of an auxiliary gear-box for accessories. The Taurus, a fourteen-cylinder two-row radial with single-speed supercharger, has a smaller bore and stroke than the Perseus.

The Hercules has been developed through many series. In eight years its output has been increased from 1,375 h.p. to 1,800 h.p., a gain in power of over 30% which has been obtained at the expense of only about 10% increase in engine weight.

The latest product of the company is the eighteen-cylinder Centaurus engine which covers the 2,500-3,500 h.p. range.

From the beginning of the re-armament programme in 1936 to the end of the European war, the Bristol company, its dispersal plants and shadow factories built over 101,000 engines, of which 57,400 were Hercules, 2,500 Centaurus, 20,700 Mercury and 14,400 Pegasus. In addition the company's service engineers repaired and put back into service during the war over 21,000 salvaged engines.

In the gas-turbine field the Bristol Aeroplane Co., Ltd. has concentrated on the evolution of a type of turbine in which the bulk of the power is used to drive a variable-pitch airscrew, while means are provided for the recuperation of heat energy which would otherwise be lost in the jet discharge. For details of this branch of the company's activities see pages 6-8d.

THE BRISTOL CENTAURUS.

In readiness for the intended programme of still larger and heavier multi-engined bombers and flying-boats, the Bristol company designed just prior to the war, the Centaurus eighteen-cylinder double-row radial sleeve-valve engine, which was first tested in 1938 at over 2,000 B.H.P. By 1943 the Centaurus IV was in full production, with a maximum power rating of 2,375 B.H.P. and was first used in the Vickers Warwick twin-engined long-range bomber-reconnaissance aircraft. At the same time, the Bristol company had been requested to submit proposals for a radial engine installation in the Hawker Tornado single-engined single-seat fighter, and the Centaurus was successfully installed and flight tested in a prototype of this machine. The subsequent production development was the Hawker Tempest II which, fitted with the Centaurus V engine of 2,500 B.H.P., set new standards of high performance and manoevrability in this class, and is continuing in service with the R.A.F.

Centaurus VII and XI engines of comparable power, equip the Bristol Buckingham twin-engined medium bomber, the Bristol Buckmaster advanced twin-engined trainer, and the Short Shetland four-engined flying-boat. The Centaurus IX and X, also of this series, are used in the Blackburn Firebrand single engined carrier-based fighter torpedo bomber.

Following the successful experience with the Tempest II, a later Centaurus type, the XVIII, has been chosen for the Hawker Sea Fury and is now in production for this very high-performance carrier-based fighter. The Centaurus 57 and 58 are also in production for the Bristol Brigand twin-engined attack aircraft and the Fairey Spearfish carrier-based torpedo bomber and general-reconnaissance machine. These engines develop up to 2,800 B.H.P.

The Centaurus 130, now under development, carries the power output of this engine well into the 3,000 B.H.P. plus range, and will be used in the Airspeed Ambassador high-speed twin-engined transport aircraft.

The Bristol Brabazon I long-range airliner of 275,000 lbs. (124,850 kg.) gross weight, is being fitted initially with eight Centaurus XX engines coupled in pairs, by special reduction-gears, to four sets of contra-rotating airscrews.

The following are the principal versions of the Centaurus engine which are now available:—

Centaurus 57. Twin-entry two-speed supercharger engine with rigid mounting-ring and vertically-mounted starter. 0.400 airscrew reduction-gear.

Centaurus 58. Mark 57 with 0.444 airscrew reduction-gear. Interconnected throttle and airscrew control.

Centaurus 59. Mark 58 but with flexible engine-mounting.

Centaurus XX. Mark 57 without reduction-gear and adapted for coupled installation.

Centaurus 130. Twin-entry single-speed "M" ratio engine with dynamic suspension-type flexible mounting. Front ignition. Torquemeter-type reduction-gear with provision for braking-airscrews.

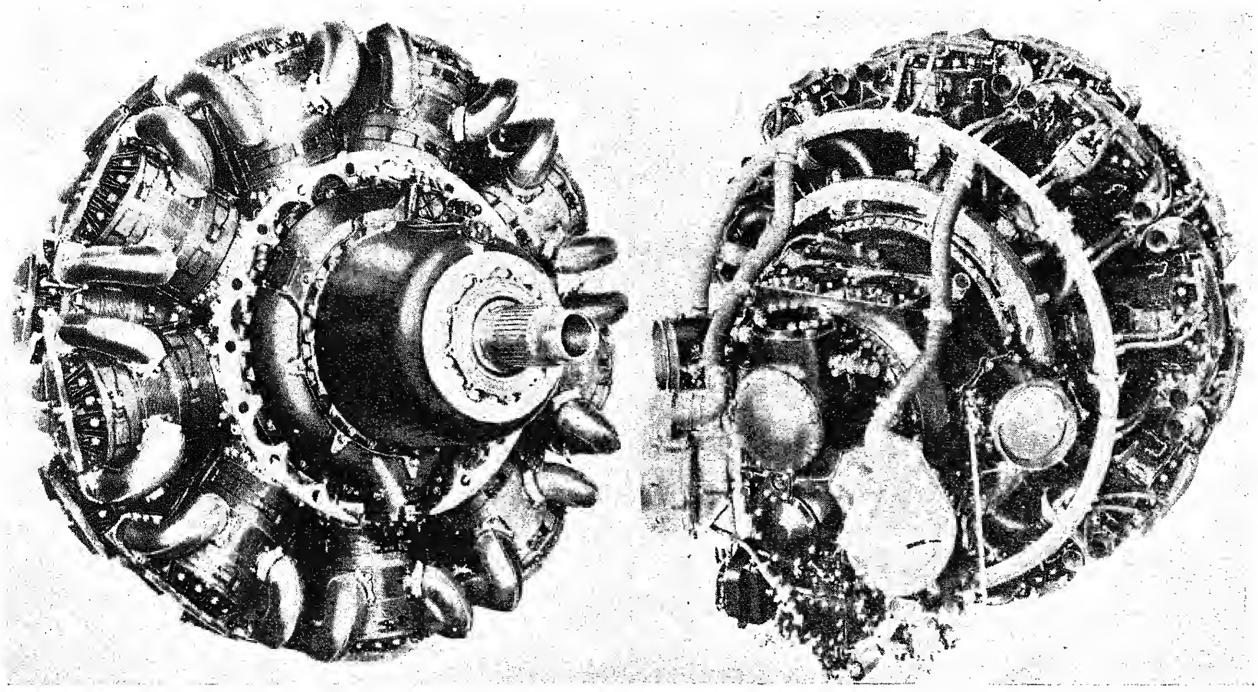
Type.—Eighteen-cylinder two-row air-cooled sleeve-valve radial with two-speed supercharger.

Cylinder Assembly.—Bore 5.75 in. (146 m/m.), Stroke 7 in. (178 m/m.), Swept Volume 3,270 cu. in. (53.6 litres). Open-ended barrels, with deep closely-pitched fins, machined from solid. Each barrel retained by sixteen large-diameter securing studs, the nuts for which are locked by spring locking plates. Cylinder heads of two-piece type, with screwed-in spark plug adaptors and provision for fitting of thermocouples.

Sleeve-Drive.—See Hercules.

Pistons.—Each piston is fitted with two wedge-section gas rings, a channel section scraper-ring, and a normal type bottom scraper ring. Fully-floating gudgeon pins retained by circlips.

Crankcase.—The main case is in three sections of forged aluminium-alloy. The front, centre and rear sections are bolted together, the joints being on the vertical centre-line of the cylinders. The bolts for the rear section are made long enough also to secure the blower casing. Each section carries a housing for a crankshaft main bearing, and the front and rear sections also contain roller bearings for the front and rear sleeve-cranks. These sections also carry the sleeve crank gear-trains for their respective cylinder banks. The front cover encloses the front bank sleeve-drive mechanism, carrying nine plain bearings for the forward ends of the sleeve cranks, and locating the three layshafts for the intermediate wheels of the sleeve crank gear-trains. A pressure oil supply to the sleeve cranks is provided through integral passages to the plain bearings. A crankshaft main bearing of the parellel roller-type is fitted in the centre bore of the casting. An airscrew constant-speed unit is mounted at the top of the front cover, and driven through an auxiliary gear train off the sleeve-crank wheels. Oil passages drilled in the casting supply oil to the unit, and also lead the high-pressure delivery oil to the reduction-gear case.



Two views of the Bristol Centaurus eighteen-cylinder two-row sleeve-valve engine.

The rear cover carries drives for the magnetos and auxiliary drive. The starter, which is arranged in a vertical position, drives the crankshaft through bevel gears. An auxiliary-drive facing to supply power for a separate accessory gearbox is provided and has a capacity of 30 h.p.

CRANKSHAFT.—Built-up in three sections, the front and rear portions being attached to the centre section by maneton joints, each secured by two bolts. The shaft runs in three high-capacity main bearings of the spherical roller, self-aligning pattern. Shrunk on to the two crankpins are white-metalled sleeves which form the big-end bearings. They are lubricated by pressure oil through drilled passages in the crankshaft. Each of the two balance weights contain two vibration damping units of the Salomon pattern. Three oil jets are also provided in the crankshaft, one in each balance-weight and one in the centre section. This latter sprays oil on to the centre main bearing, while the other two lubricate the pistons and sleeves of their respective cylinder banks.

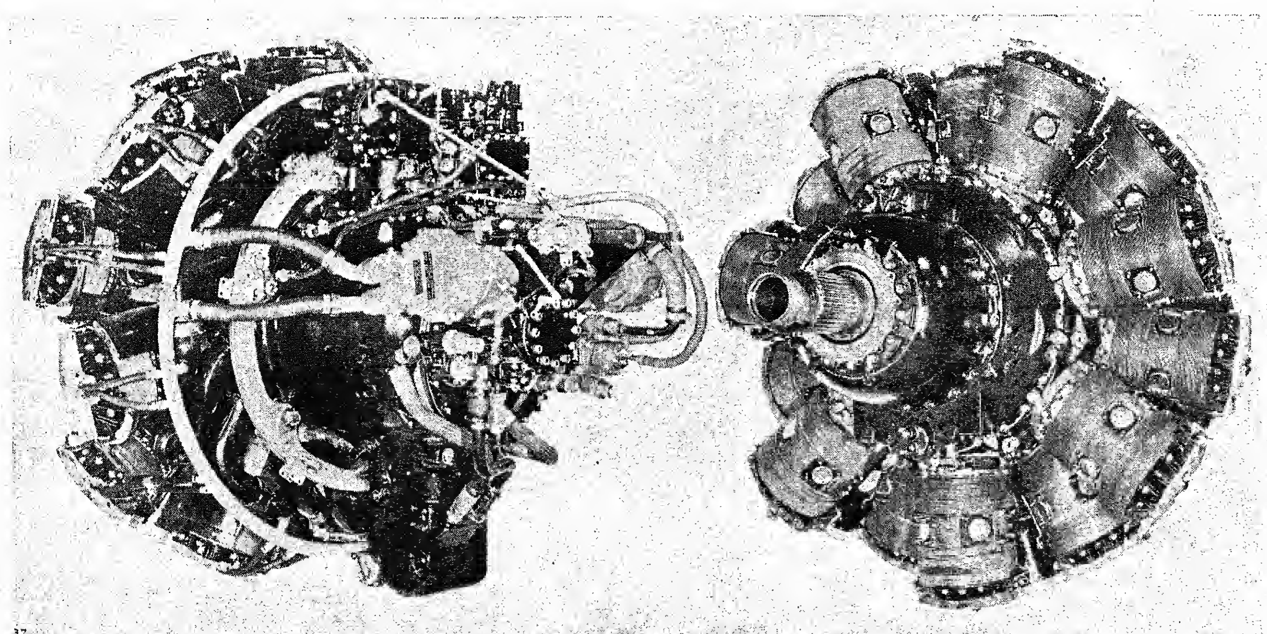
CONNECTING RODS.—An articulated connecting-rod system is employed for each bank of cylinders. Pressure lubrication of the wrist-pin bearings is provided through an oil retainer, while the small ends are supplied by splash lubrication and the balance-weight oil jets. Oil retainers are fitted at each side of the big-end assemblies to control the rate of leakage and to ensure that full oil pressure is maintained in the bearings.

REDUCTION GEAR.—Epicyclic bevel unit with a ratio of 0.44 to 1. Power from the crankshaft is transmitted to the rear bevel wheel through a toothed coupling, and the wheel is positioned by a ball thrust-bearing located in a spherical seating. The airscrew shaft has three trunnion arms, which carry the bevel pinions. Lead bronze bushes are pressed into the bores of the pinions and longitudinal location is achieved by ball thrust-bearings secured on the ends of the trunnion arms. The front bevel wheel is stationary, being secured to the reduction gear case by a toothed coupling, and located on a spherical seating. As both front and rear wheels are able to tip slightly, the load is distributed evenly over the three pinions regardless of manufacturing tolerances. The airscrew shaft runs on two bearings, the rear comprising a lead-bronze sleeve pressed into the end of the crankshaft, and the front a large ball bearing which also takes airscrew thrust. An oil transfer sleeve is arranged on the airscrew shaft to transmit oil from the constant-speed unit to the airscrew through the hollow forward end of the shaft. The supercharger gear-ratio control valve is located in the top of the crankcase rear cover and is supplied, and delivers, through internal oil passages in the casting.

SUPERCHARGER.—The centrifugal supercharger uses a double-shrouded light alloy impeller which is carried on a shaft supported by two ball bearings, of which the front is self-aligning and the rear of normal pattern. Two blower gear ratios available, selection being by two compound hydraulic clutches. The oil for clutch actuation passes through two centrifuges. The units are located at the top of the blower casing and are readily accessible for cleaning. The clutches are driven by a spring-drive gear on the crankshaft, this unit protecting the drive from cyclic torque variations.

OIL SUMP.—The oil sump is a large capacity casting bolted on to the underside of the supercharger. It has an easily accessible oil filter, and carries the petrol and oil pumps which are driven by shafts powered from the rear-cover gear trains. This arrangement ensures that the scavenge oil pump is always submerged. A small gear-driven scavenge oil pump is fitted in the base of the front cover casting and is driven off the sleeve-crank train. Its purpose is to remove surplus oil from the forward end of the engine, and return it to the sump through an external pipe.

WEIGHTS AND PERFORMANCE.—See Table.



Two views of the Bristol Hercules fourteen-cylinder two-row sleeve-valve engine.

BRISTOL—*continued.*

THE BRISTOL HERCULES.

The most widely-used versions of the Hercules during the war were the VI and XVI Series which powered the Stirling III and IV, Halifax III and VII and Lancaster II four-engined bombers, the Wellington X twin-engined bomber and the Beaufighter VI twin-engined fighter.

The Hercules XVII and XVIII engines differed from the XVI in having cropped supercharger-impellers, giving an increase in power for take-off and low-altitude work, and were installed in Beaufighter and Wellington aircraft serving with Coastal Command.

Towards the end of the war the Hercules 100 was produced with a maximum power of 1,800 B.H.P., and a very substantial increase in full throttle altitude, achieved by a major development in two-speed supercharger design. This engine, which embodied the accumulated experience of the vast scale of military operation of the earlier Hercules types throughout the war, was subsequently taken as the design basis for the present Hercules series of engines for post-war commercial service.

Following the successful use of the Hercules 100 in the Halifax VI bomber, a substantially identical engine, the Hercules 101, is equipping the Handley Page Hastings four-engined military transport, while the civil prototype version of this new aircraft, the Hermes, has Hercules 120 engines which are again similar to the 100 series, but developed to give higher performance in respect of economy cruising conditions at very high altitudes. Hercules 120 engines are installed in a prototype Avro Tudor IV transport.

The Hercules 630 engine with single-speed supercharger is used in the Vickers Viking twin-engined medium-range transport, while the Hercules 632 of almost identical specification, powers the Bristol Freighter and Wayfarer twin-engined civil transports.

The very successful war record of the Short Sunderland flying-boats with Bristol Pegasus engines, and the experience with the Hercules-engined "G" class flying-boats, led to the introduction of the Short Seaford as a development of this class, which is now in production with Hercules XIX engines. A civil version of this aircraft for use by British Overseas Airways is also in production. Named the Solent, it is equipped with Hercules 637 engines.

The Hercules 230 (Military) and 730 (Civil) are the latest developments of this famous series, with power outputs extending well into the 2,000/2,500 B.H.P. range, a range hitherto only covered for normal service use by considerably larger power-units. Type tested and put into production with a take-off rating of 2,000 B.H.P., the Hercules 230 shows an increase of 310 B.H.P. over the previous series obtained on standard 100/130 grade fuel without water-injection. With the imminent advent of fuels of better than 100 octane, the maximum power of the Hercules 230 and its successors will show a further substantial increase.

The following are the principal types of Hercules engine now available :—

MILITARY AND PROTOTYPE SERIES.

Hercules 101. Two-speed supercharger engine with rear-swept exhaust system.

Hercules 120. Mark 101 modified for high-altitude rating and 150 h.p. accessory drive. Submerged oil pumps and vertically-mounted starter.

Hercules 121. Mark 120 with torquemeter to suit braking airscrew.

Hercules 230. Mark 101 with power section re-designed for higher duty and with single-speed supercharger.

Hercules 231. Mark 230 with torquemeter to suit braking airscrew.

CIVIL SERIES.

Hercules 630. Single-speed supercharger engine with front exhaust manifold and four-point mounting ring.

Hercules 631. Mark 630 with torquemeter-type reduction-gear.

Hercules 632. Mark 630 with six-point mounting ring and rear-swept exhaust system.

Hercules 633. Mark 632 with torquemeter-type reduction-gear.

Hercules 634. Mark 630 with modified four-point mounting ring and rear-swept exhaust system to suit rear manifold.

Hercules 635. Mark 634 with torquemeter-type reduction-gear.

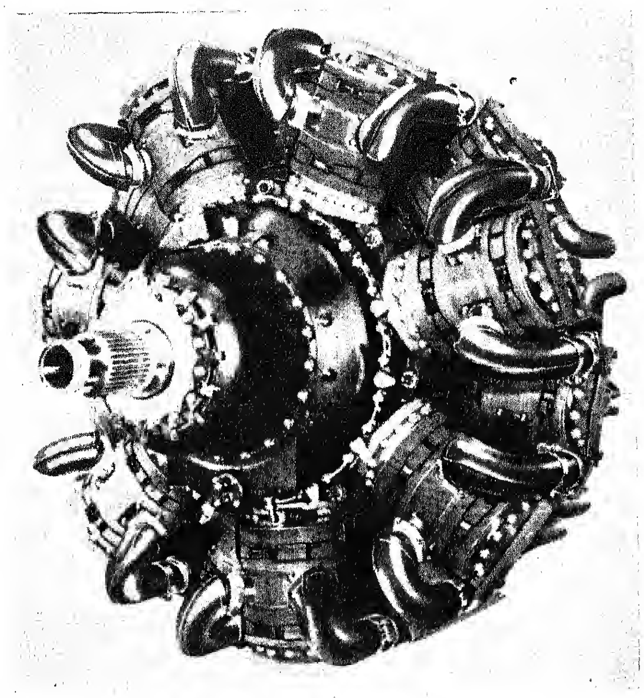
Hercules 636. Mark 630 with special mounting attachments to suit monocoque installation.

Hercules 637. Mark 636 with torquemeter-type reduction-gear.

Hercules 730. Mark 630 with power section redesigned for higher duty.

Hercules 731. Mark 730 with torquemeter-type reduction-gear.

Note.—Hercules engines when produced specifically for civil purposes are distinguished by the addition of 500 to the basic mark numbers. For example, the Hercules 730 is the civil version of the Hercules 230, and so on.



The 2,000 h.p. Bristol Hercules 230 engine.

The Hercules 230 and its variants closely resemble their predecessors in general layout. To ensure high reliability and long life with the latest increases in power, important improvements in detail design and construction have been incorporated. The crankcase has been strengthened and modified to accommodate crankshaft main bearings of considerably increased load capacity. The number of studs securing the cylinders to the crankcase has been increased, and the cylinders themselves have been strengthened and are machined from aluminium-alloy forgings produced by an improved process. Better material is also used for the sleeves, and the pistons are of stiffened design.

A notable advance has been achieved in the cylinder head design. Previously, this component was an assembly of two aluminium-alloy castings. The new head consists of a copper base with close-pitched cooling fins, machined from the solid on its outward side, and a steel skirt into which the copper base is secured. The steel skirt is flanged for attachment of the head to the cylinder barrel. The inner side of the copper base, which forms the "roof" of the combustion chamber, is faced with nickel as a protection against corrosion.

The main advantages of this new cylinder head are that the copper base gives much better conductivity of heat from the flame face, and that the steel skirt enables freer entry and exit to be provided for the cooling air. The construction also gives a high degree of strength and stiffness.

The improvement obtained in engine cooling is such that, compared with the previous aluminium type, the new heads run some 25°C. cooler for a given boost and cooling air pressure drop. Alternatively, the cooling air pressure drop can be halved for a given boost and head temperature.

The maximum boost that can be used within safe limits of cylinder conditions, and without incurring any penalty in cooling drag, has therefore been substantially increased..

The Hercules 230 and its variants are available as complete power-plants of the latest "Bristol" low-drag design, which in addition to its excellent aerodynamic qualities, embodies a number of practical advantages in accessibility and convenience for servicing.

TYPE.—Fourteen-cylinder sleeve-valve two-row radial air-cooled.

CYLINDERS.—Bore 5¾ in. (146 m/m.), Stroke 6½ in. (165 m/m.), Capacity 2,360 cub. in. (38.7 litres). Forged aluminium-alloy cylinder barrels, with close-pitched fins machined from solid. Composite cylinder-heads having copper bases with close-pitched fins machined from solid, and forged steel skirts. Each head has two wedge-section gas rings. Special alloy-steel cylinders sleeves with ball-joint couplings to sleeve driving-cranks.

SLEEVE DRIVE.—By simple spur gear trains from front end of crankshaft, driving short cranks for the front sleeves and extrended cranks passing through the forward crankcase section to the rear sleeves. Each sleeve crank is carried at its rear end in a high-capacity roller bearing housed in the crankcase, and at the front in a bush in the crankcase front cover. Intermediate gears run on needle-roller bearings.

PISTONS.—Full-skirted type, machined from aluminium-alloy forgings, and each having two wedge-section gas rings and a channel-section

BRISTOL—*continued.*

scraper ring above the gudgeon-pin, and one bevelled scraper-ring in the skirt. Robust case-hardened steel gudgeon-pins, fully-floating in piston bosses and bronze-bushed small ends of connecting-rods.

Connecting Rods.—Front and rear assemblies each comprising one master-rod. bearing directly on the white-metalled crankpin sleeve, and six articulated rods with bronze-bushed eyes bearing on wrist-pins carried in the master-rod. All rods are high-tensile alloy-steel forgings.

Crankshaft.—Three-piece type in forged high-tensile alloy steel, carried in four high-capacity roller bearings. Crankpins formed integral with centre section, and fitted with white-metalled fixed sleeves for big-end bearings. Front and rear sections secured to centre section by maneton joints.

Crankcase.—In three sections, produced from light alloy forgings and carrying housings for three main crankshaft bearings and fourteen sleeve crank bearings.

Front Cover.—An aluminium-alloy casting enclosing the sleeve-drive mechanism and carrying the airscrew constant-speed unit at the top and an auxiliary oil scavenge pump at the bottom. The fourth roller-bearing for the crankshaft is housed in the cover.

Rear Cover.—A simple magnesium-alloy casting carrying magnetos, oil pump, fuel pump and electric starter, and incorporating an auxiliary drive for coupling to an aircraft accessory gearbox.

Supercharger and Induction System.—Single-speed supercharger, with magnesium-alloy casing having single direct entry contoured for minimum drag and shock-free transit of mixture to impeller eye through guide vane rotor carried on impeller shaft. Aluminium alloy double-shrouded impeller mounted on hollow alloy steel shaft driven from rear end of crankshaft through concentric main drive shaft spring-drive gear and two compound intermediate gear units embodying centrifugal clutches. Vaned diffuser-ring encircling impeller passes compressed mixture to diffuser chamber, whence fourteen equi-length aluminium-alloy induction pipes lead to cylinders.

Fuel System.—Hobson-R.A.E. bulk fuel injector and master control, having the following inherent advantages :—(*a*) Fuel metered by basic factors of engine speed, manifold pressure, charge temperature and back pressure ; positively ensuring correct air-fuel ratio under all operating conditions. (*b*) Fully automatic and accurate correlation of manifold pressure with mixture strength, enabling high B.M.E.P. to be used for optimum fuel economy, without risk of damage to the engine, and greatly reducing the burden of responsibility on the pilot. (*c*) Pressure atomisation of fuel, promoting smooth running and flexibility, and further enhancing fuel economy. (*d*) Carburation unaffected by any sudden changes in flight attitude of aircraft. (*e*) Immunity from icing, fuel being injected into airstream after the throttles, the latter and their housing being oil-heated.

Igniton System.—Dual ignition, by two fourteen-cylinder type magnetos independently serving two ceramic-insulated sparking plugs in each cylinder. Magnetos and H.T. leads to plugs fully-screened, and leads housed in waterproof conduit-harness. Variable timing device in magneto drive in rear cover, automatically selecting optimum ignition setting for each running condition.

Lubrication System.—Direct pressure lubrication from oil pump on rear cover, through hollow main drive shaft and crankshaft to big-end bearings, wrist-pin bearings and airscrew reduction gear. Splash lubrication, supplemented by pressure spray from oil jets in crankshaft, to pistons, sleeves and crankshaft roller-bearings. Supercharger and rear-cover drive bearings pressure-lubricated through main drive shaft and internal passages in casing. Separate pressure line via metal element filter to sleeve drive and to airscrew constant speed unit. Main scavenger pump, driven in tandem with pressure pump as one unit, draws oil through main filter from float-controlled constant-level oil sump under rear section of engine ; supplementary scavenge pump driven from sleeve crank gear in front cover delivers drainage oil from front section to sump.

Reduction Gear.—Epicyclic bevel-gear type, with the bevel wheels carried on spherical seatings to ensure equal load distribution over the three bevel pinions. Rear bevel wheel driven from crankshaft through toothed coupling, and its thrust carried by ball-race mounted on airscrew shaft tail-piece. Front stationary bevel wheel locked to gear case by toothed coupling. Bevel pinions carried on three trunnion arms integral with airscrew shaft, with ball thrust-races at outer ends. Heavy-duty main ball thrust-bearing at forward end of casing. Internal oilways in casing for airscrew control oil supply from constant-speed unit.

Exhaust System, Cylinder Baffles, Etc.—Engine supplied complete with stainless-steel exhaust pipes, swept back from the exhaust ports at the front of each cylinder, to a point aft of the rear cylinders suitable for attachment of either individual tail pipes or grouped exhaust manifolds. Inter-cylinder baffles and cylinder head baffles designed in conjunction with exhaust system to meet co-ordinated requirements of efficient cylinder cooling, minimum drag, compactness and reliability.

Engine Mounting.—A stiff, square-section ring, formed from solid-drawn steel tube and carrying forged lugs for the power-plant mounting structure attachments, is built into the engine immediately behind the supercharger casing. The Hercules 230 ring has four attachment points, but six are provided on variants of the basic engine.

Weights and Performance.—See Table.

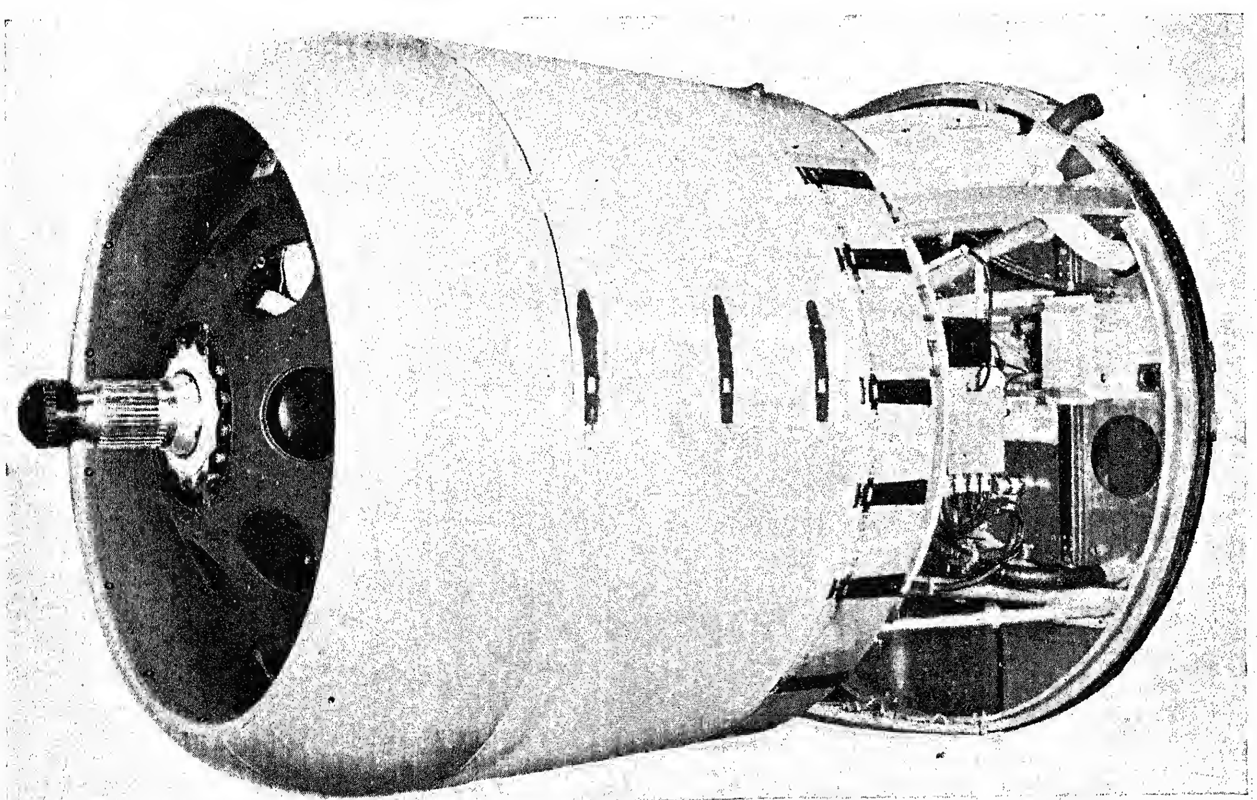
THE BRISTOL LOW-DRAG POWER-PLANT.

The Hercules 230 and its variants are available as complete power-plants of the latest Bristol low-drag design. The following particulars relate to typical features of the Bristol low-drag power-plant :—

Engine Mounting Structure.—Fully-braced structure of steel tubes with welded-on forged end fittings providing four or six point attachment to the engine mounting ring and six or four point attachment to airframes.

Shoulder Cowl.—Of fireproof construction with sheet steel panels arranged to provide a double annular air exit ; one annulus for the main engine cooling air emerging from the engine bay and the other for the oil cooler air emerging from the accessory bay.

Engine and Accessory Bay Cowling.—Low drag cowling assembly, comprising nose cowl and engine cowl supported on two rings attached to engine, and accessory bay cowl supported on rear of shoulder cowl and on a ring attached to engine mounting structure. All cowls are of aluminium alloy sheet construction, amply provided with stiffening members and with steel fittings where necessary. Nose cowl is in three self-aligning sections, the upper sections being removable for access to front of engine. Engine and accessory



The Bristol Hercules low-drag Power-unit ready for installation.

***BRISTOL**—continued.*

bay cowls have hinged main access panels with quick-release toggle fasteners and folding support struts.

CONTROLLABLE GILLS.—Hinged plate type gills carried on support ring attached to engine. Chain and sprocket drive suitable for either manually or thermostatically controlled electric motor operation. Detail disposition of fixed and moveable gill plates around periphery of cowl can be adapted to suit particular aircraft requirements, or may be replaced by fixed exit annulus.

AIR INTAKES.—Designs available either for air intake ducts fully submerged within cowling, for connexion to wing leading-edge entries; or for external intake scoops where wing construction precludes the former ideal arrangement. In either case the intake system in the power plant embodies electric jack-operated shutters enabling the pilot to select either cold ram air, cold filtered air or warm air. Air filter elements have ample area and low pressure losses. Supplementary inertia cleaning provided byshape of air entry louvres. Warm air supply automatically put into circuit by engine suction if cold air intake ices up unknown to pilot. Separate intake system for oil cooler, with controllable exit shutters operated by electric motor with either manual or thermostatic control.

FUEL AND OIL SYSTEMS.—Fuel system designed for use in conjunction with backing pumps at the fuel tanks. Feed pipe in power plant delivers to main engine pump through a filter. Engine pump delivers to injector through another filter. Pressure transmitter included in feed line operating warning light in cockpit should fuel pressure fall below specified minimum. Oil system includes oil cooler with thermostatically controlled airflow shutters, and balanced relief valve protecting cooler elements from excessive scavenge oil pressures. Provision made for use of Worth dilution system if required to facilitate starting at very low temperatures. All pipes in fuel and oil systems fireproofed to meet latest Civil and Military requirements.

BRISTOL SLEEVE-VALVE ENGINES.

	Bore and Stroke	Capacity	Gear Ratio	Diameter	Weight (dry)	Take-off Power	Maximum Power for all-out level flight for 5 mins.	Normal Climb	Maximum Economical Cruising	Octane No. and Grade
HERCULES 101	5¾ in. × 6½ in. (146 m/m. × 165 m/m.)	2,360 cu. in. (38.7 litres)	0.44 : 1	52 in. (1.32 m.)	2,045 lbs. (928 kg.)	1,675 h.p. at 2,800 r.p.m.	1,800 h.p. at 2,800 r.p.m. at S/L and 1,625 h.p. at 2,800 r.p.m. at 19,500 ft. (5,950 m.)	1,515 h.p. at 2,400 r.p.m. at 7,750 ft. (2,365 m.) and 1,415 h.p. at 2,400 r.p.m. at 16,500 ft. (5,030 m.)	1,215 h.p. at 2,400 r.p.m. at 12,250 ft. (3,730 m.) and 1,125 h.p. at 2,400 r.p.m. at 21,000 ft. (6,400 m.)	100/130
HERCULES 120 and 121	5¾ in. × 6½ in. (146 m/m. × 165 m/m.)	2,360 cu. in. (38.7 litres)	0.44 : 1	52 in. (1.32 m.)	Mk. 120 2,025 lbs. (920 kg.) Mk. 121 2,060 lbs. (934 kg.)	1,715 h.p. at 2,800 r.p.m.	1,800 h.p. at 2,800 r.p.m. at 6,000 ft. (1,830 m.) and 1,465 h.p. at 2,800 r.p.m. at 23,000 ft. (7,010 m.)	1,475 h.p. at 2,400 r.p.m. at 6,000 ft. (1,830 m.) and 1,290 h.p. at 2,400 r.p.m. at 21,000 ft. (6,300 m.)	1,230 h.p. at 2,400 r.p.m. at 10,750 ft. (3,280 m.) and 1,090 h.p. at 2,400 r.p.m. at 25,250 ft. (7,695 m.)	100/130
HERCULES 230 and 231	5¾ in. × 6½ in. (146 m/m. × 165 m/m.)	2,360 cu. in. (38.7 litres)	0.44 : 1	52 in. (1.32 m.)	Mk. 230 2,060 lbs. (934 kg.) Mk. 231 2,095 lbs. (950 kg.)	2,000 h.p. at 2,800 r.p.m.	2,055 h.p. at 2,800 r.p.m. at 3,500 ft. (1,070 m.)	1,605 h.p. at 2,400 r.p.m. at 4,750 ft. (1,430 m.)	1,305 h.p. at 2,400 r.p.m. at 11,500 ft. (2,135 m.)	100/130
HERCULES 630, 634 and 636	5¾ in. × 6½ in. (146 m/m. × 165 m/m.)	2,360 cu. in. (38.7 litres)	0.44 : 1	52 in. (1.32 m.)	1,905 lbs. (864 kg.)	1,690 h.p. at 2,800 r.p.m.	1,795 h.p. at 2,800 r.p.m. at 7,250 ft. (2,210 m.)	1,550 h.p. at 2,400 r.p.m. at 4,750 ft. (1,430 m.)	1,330 h.p. at 2,400 r.p.m. at 9,250 ft. (2,820 m.)	100/130
HERCULES 631, 635 and 637	5¾ in. × 6½ in. (146 m/m. × 165 m/m.)	2,360 cu. in. (38.7 litres)	0.44 : 1	52 in. (1.32 m.)	1,940 lbs. (880 kg.)	1,690 h.p. at 2,800 r.p.m.	1,795 h.p. at 2,800 r.p.m. at 7,250 ft. (2,210 m.)	1,550 h.p. at 2,400 r.p.m. at 4,750 ft. (1,430 m.)	1,330 h.p. at 2,400 r.p.m. at 9,250 ft. (2,820 m.)	100/130
HERCULES 632 and 638	5¾ in. × 6½ in. (146 m/m. × 165 m/m.)	2,360 cu. in. (38.7 litres)	0.44 : 1	52 in. (1.32 kg.)	1,915 lbs. 869 kg.	1,690 h.p. at 2,800 r.p.m.	1,795 h.p. at 2,800 r.p.m. at 7,250 ft. (2,210 m.)	1,550 h.p. at 2,400 r.p.m. at 4,750 ft. (1,430 m.)	1,330 h.p. at 2,400 r.p.m. at 9,250 ft. (2,820 m.)	100/130
HERCULES 633 and 639	5¾ in. × 6½ in. (146 m/m. × 165 m/m.)	2,360 cu. in. (38.7 litres)	0.44 : 1	52 in. (1.32 m.)	1,950 lbs. (884 kg.)	1,690 h.p. at 2,800 r.p.m.	1,795 h.p. at 2,800 r.p.m. at 7,250 ft. (2,210 m.)	1,550 h.p. at 2,400 r.p.m. at 4,750 ft. (1,450 m.)	1,330 h.p. at 2,400 r.p.m. at 9,250 ft. (2,820 m.)	100/130
HERCULES 730 and 731	5¾ in. × 6½ in. (146 m/m. × 165 m/m.)	2,360 cu. in. (38.7 litres)	0.44 : 1	52 in. (1.32 m.)	Mk. 730 2,060 lbs. (934 kg.) Mk. 731 2,095 lbs. (950 kg.)	1,950 h.p. at 2,800 r.p.m.	2,020 h.p. at 2,800 r.p.m. at 4,500 ft. (1,370 m.)	1,605 h.p. at 2,400 r.p.m. at 4,750 ft. (1,450 m.)	1,305 h.p. at 2,400 r.p.m. at 11,500 ft. (3,500 m.)	100/130
CENTAURUS 57, 58 and 59	5¾ in. × 7 in. (146 m/m.) × 178 m/m.)	3,270 cu. in. (53.6 litres)	0.40 : 1	55.3 in. (1,405 m/m.)	Mk. 57 2,780 lbs. (1,261 kg.) Mk. 58 2,790 lbs. (1,266 kg.) Mk. 59 2,870 lbs. (1,302 kg.)	2,500 h.p. at 2,700 r.p.m. or * 2,825 h.p. at 2,700 r.p.m.	2,580 h.p. at 2,700 r.p.m. at 4,000 ft. (1,220 m.) or * 2,840 h.p. at 2,700 r.p.m. at 750 ft. (230 m.) and 2,315 h.p. at 2,700 r.p.m. at 16,750 ft. (5,100 m.) or * 2,610 h.p. at 2,700 r.p.m. at 14,250 ft. (4,345 m.)	2,190 h.p. at 2,400 r.p.m. at 5,000 ft. (1,525 m.) and 2,000 h.p. at 2,400 r.p.m. at 16,000 ft. (4,880 m.)	1,790 h.p. at 2,400 r.p.m. at 1,100 ft. (3,355 m.) and 1,640 h.p. at 2,400 r.p.m. at 21,500 ft. (6,555 m.)	100/130
CENTAURUS 130	5¾ in. × 7 in. (146 m/m. × 178 m/m.)	3,270 cu. in. (53.6 litres)	0.40 : 1	56.5 in. (1,435 m/m.)	2,980 lbs. (1,352 kg.)	2,600 h.p. at 2,700 r.p.m. or *3,000 h.p. 2,700 r.p.m.	2,680 h.p. at 2,700 r.p.m. at 4,000 ft. (1,220 m.) or *3,000 h.p. at 2,700 r.p.m. at S/L.	2,165 h.p. at 2,400 r.p.m. at 5,000 ft. (1,525 m.)	1,805 h.p. at 2,400 r.p.m. at 9,500 ft. (2,895 m.)	100/130

Note:—* Indicates outputs using methanol/water injection.

ELECTRICAL SYSTEM.—Embodies all necessary fireproofing, and screening and bonding to prevent radio interference. Cables passing through bulkhead have quickly detachable shielded plugs to facilitate rapid changing of power plants.

FIRE EXTINGUISHER SYSTEM.—Methyl bromide spray type system, with three spray rings, one at the front of the engine, one at the rear, and one in the accessory bay, with a separate spray nozzle in the engine induction system, all supplied by separate spray nozzle in the engine induction system, all supplied by separate bottles. Continuous-cord type flame detector operates warning light on feathering button in cockpit and prepares spray system for action. Subsequent depression of feathering button automatically starts spray concurrently with airscrew-feathering.

EXHAUST SYSTEM.—Either individual tailpipes, or twin outlet uniflow type manifolds, can be provided, connecting with the swept back exhaust pipes in the engine. All pipes and manifolds of stainless steel construction.

CIRRUS.

THE CIRRUS ENGINE DIVISION OF BLACKBURN AIRCRAFT, LTD.

HEAD OFFICE AND WORKS: ENGINE DEPT., BROUGH, E. YORKS.

Joint Managing Directors: R. Blackburn, O.B.E., A.M.I.C.E., F.R.Ae.S., M.I.Mech.E. (Chairman), and Major F. A. Bumpus, B.Sc., A.R.C.S., Wh.Sc., F.R.Ae.S.

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Secretary: A. F. Jopling, A.C.A.

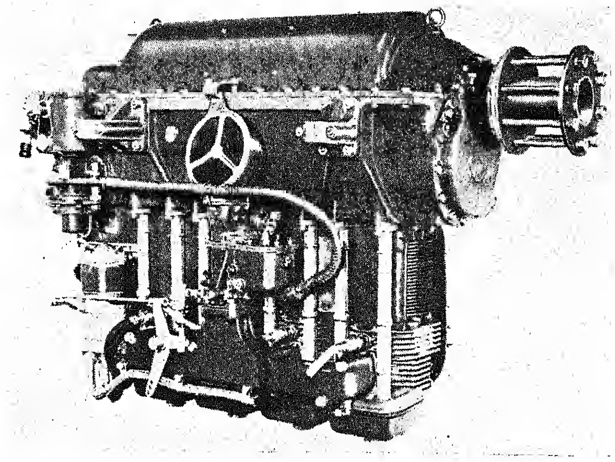
The Cirrus aero-engine, the pioneer light four-cylinder in-line air-cooled engine, made possible the light aeroplane of today, and its long list of successes in light aircraft of many types dates back to 1925.

In 1934 the manufacture of these engines was taken over by Blackburn Aircraft Ltd., and a new series of engines was produced which achieved further excellent results in many different aircraft.

The first of these, the Cirrus Minor of 90 h.p., in the Auster I Army observation monoplane, saw active service in France, Libya, Tripoli and Tunisia with marked success and a fine record for reliability. The R.A.F. type, which embodies a number of alterations from the pre-war civilian model, is known as the Cirrus Minor Series I.

A new engine, the Cirrus Minor Series II of 100 h.p. which is installed in the Auster J/1 Autocrat light monoplane, is now added to the Cirrus range, which also includes the Major Series II of 150 h.p. and the Major Series III of 155 h.p. The four types are described hereafter.

Under development there is a completely new series of light air-cooled inverted engines,—the four-cylinder 180 h.p. Bombardier; the six-cylinder 265 h.p. Musketeer; and the 300 h.p. supercharged six-cylinder Grenadier. These engines will be of completely new design and will incorporate several new features, including direct fuel-injection. Engines of this new series are not likely to be in production for at least twelve months.



The 90 h.p. Cirrus Minor Series I engine.

THE 90 h.p. CIRRUS MINOR SERIES I.

TYPE.—Four-cylinder in-line inverted air-cooled.

CYLINDERS.—Bore 3.73 in. (95 m/m.), Stroke 5 in. (127 m/m.). Capacity 3,605 c.c. Compression ratio 5.87 : 1. The high-grade carbon steel cylinders with machined fins have detachable Y-alloy heads attached by eight studs to a flange on the barrels. A gas-tight joint is ensured by a laminated copper washer. The valve operating gear is enclosed by an Electron cover which also acts as an oil bath for the valve mechanism. The cylinders are located by short anchoring studs in the crankcase.

PISTONS.—Y-alloy of slipper type. Fully floating gudgeon pins One scraper and two compression rings.

CONNECTING RODS.—Hiduminium forgings with steel-backed white metal bearings.

CRANKSHAFT.—Steel forging carried in five plain white-metal bearings with a ball thrust bearing at the front end and fitted at the rear with a gear wheel for driving the two vertical magneto drive-shafts, which also operate the fuel pumps.

CRANKCASE.—Electron casting with all oilways carried internally and fitted with an Electron top-cover which carries a one-piece cast breather at the rear, and lifting eyes fore and aft.

VALVE GEAR.—One inlet and one exhaust valve per cylinder. Wide cooling spaces between inlet and exhaust port passages. Operation by camshaft through ball-ended push-rods, and tappets housed in the crankcase, the camshaft running direct in the crankcase casting with a bronze thrust bearing at the front end from which end the camshaft is driven through spur gears. The timing gears are at the front of engine and have a small timing cover in Electron.

IGNITION.—Two fully-screened B.T.H. SG4-2 magnetos (one with impulse starter) are driven from the crankshaft through spiral gears. Distributors face downwards. Integrally-screened sparking-plugs. Plessey-Breeze screening harness.

CARBURATION. — Claudel-Hobson down-draught carburettor, with independent mixture control and an Amal flame-trap, is mounted on a cast induction manifold. Dual fuel pumps can be fitted at rear of crankcase, one on either side, operated through plungers by cams on magneto driving-shafts.

LUBRICATION.—Pressure feed system by oscillating piston-type of oil-pump driven from rear end of camshaft. Gravity drain system. Pressure oil filter contained in separate unit on side of crankcase at rear end.

ACCESSORIES.—Optional. Amal fuel pumps, electric starter, screening harness. Kigass primer.

AIRSCREW DRIVE.—Direct. Left Hand tractor.

DIMENSIONS.—Length 37.8 in. (960 m/m.), Height 25 in. (636 m/m.). Width 17.32 in. (440 m/m.). Bearer feet bolt centres, front to rear 15.8 in. (402 m/m.). Alternative widths between centres 5.2 in. 386 m/m.), 16.65 in. (423 m/m.), 18 in. (469 m/m.).

WEIGHT.—Complete with boss, spinner, two fuel pumps and pipe-lines, bearer feet and rubbers, screening harness, cooling chute and baffles, exhaust stubs and flame trap. 238 lb. + 2 lb. (108 kg. + 0.9 kg.).

PERFORMANCE.—Normal 80 h.p. at 2,300 r.p.m. Maximum 90 h.p. at 2,600 r.p.m., Fuel consumptions full throttle at 2,300 r.p.m., 6.0 Imp gallons (27.28 litres) per hr., Cruising at 80% full power at 2,300 r.p.m., 4.59 Imp. gallons (20.85 litres) per hr., Oil consumption 1-2 pints (0.57-1.4 litres) per hr., Octane rating 70.

THE 100 h.p. CIRRUS MINOR SERIES II.

TYPE.—Four-cylinder in-line inverted air-cooled.

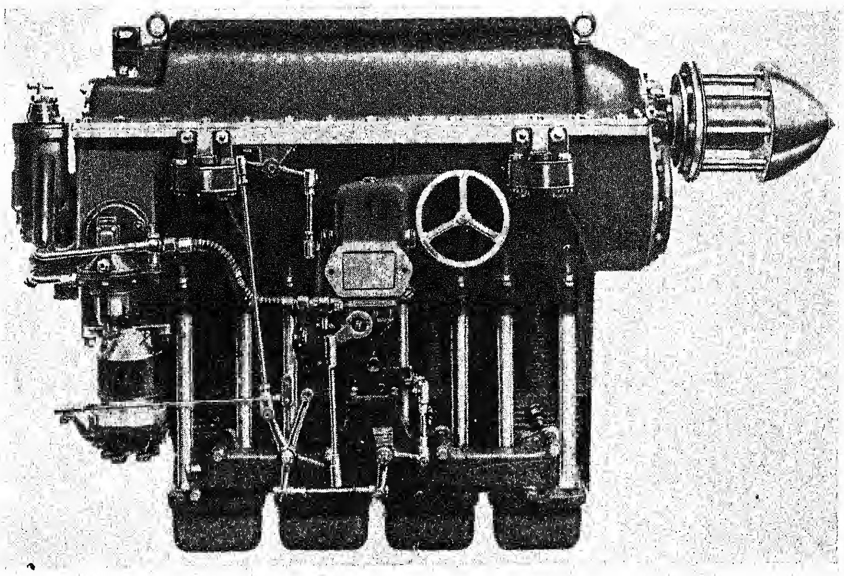
CYLINDERS.—Bore 3.9 in. (100 m/m.), Stroke 5 in. (127 m/m.), Capacity 3,990 c.c., Compression ratio 6.25 : 1. The high grade carbon steel cylinders with machined fins have detachable heads. The cylinders are located by short anchoring studs in the crankcase.

PISTONS.—Slipper type of Y-alloy. Fully-floating gudgeon-pins. One scraper and two compression rings.

CONNECTING RODS.—As Minor Series I.

CRANKSHAFT.—As Minor Series I.

CRANKCASE.—As Minor Series I.



The 100 h.p. Cirrus Minor Series II air-cooled engine.

***CIRRUS**—continued.*

CYLINDER HEADS.—Pent-roof type in Y-alloy (with one inlet and one exhaust valve) attached to cylinder top flange by eight studs and nuts. A gas-tight joint is secured by a spigot on the cylinder and a copper washer. The cylinder-head forms one half of the valve-gear chamber and has a cover-box acting as an oil bath for the valve rocker gear.

VALVE GEAR.—Operated from camshaft through cup-ended tappets and ball-ended push-rods. Clearance adjusted by screwed cup in one end of rocker with a hardened striking pad on the other. Valves stellited. The camshaft runs direct in the crankcase casting with a bronze thrust-bearing at the front end from which end the camshaft is driven through spur gears. The timing gears are at the front of engine and have a small timing cover in Electron.

IGNITION.—As Minor Series I. Screening harness available if desired.

CARBURATION.—A Zenith downdraught carburettor with independent mixture control, also hot and cold air intake, is fitted to a one-piece cast induction manifold. Warm air from the cowling is admitted through the flame-trap up to approximately 90% of the throttle opening, after which a direct cold air intake comes into operation. Provision for fire-fighting equipment is made on the hot and cold intake. Dual fuel-pumps can be fitted and are operated by cams on the magneto driving-shafts.

LUBRICATION.—Gear-type oil-pump, incorporating Auto-clean filter is fitted. Pressure-feed system to main and big-end bearings. Gravity drain system. An extension of the oil-pump spindle provides a power take-off point.

ACCESSORIES.—Optional. Amal petrol pump; Pesco or Rotax vacuum pumps; B.T.H. and Heywood Compressors; Rotax generator and starter.

AIRSCREW DRIVE.—Direct; left-hand tractor.

DIMENSIONS.—Overall length less spinner less starter 40 in. (1,013 m/m.), Height 25.6 in. (650 m/m.), Width 18 in. (455 m/m.), Bearer feet centres as Minor Series I.

WEIGHT.—Complete with airscrew hub and spinner, two fuel pumps and pipe-lines, bearer feet and rubbers, cooling chute and baffles, exhaust stubs and flame-trap. 248 lb. ± 2 lbs. (112.6 kg. ± 0.9 kg.).

PERFORMANCE.—Normal 90 h.p. at 2,300 r.p.m., Maximum 100 h.p. at 2,600 r.p.m., Fuel consumption, full throttle at 2,300 r.p.m. 6.6 Imp. gallons (30 litres) per hr., Cruising at 80% full power at 2,300 r.p.m., 5.2 Imp. gallons (23.6 litres) per hr., Oil consumption 1-2 pints (0.57-1.4 litres) per hr.

OCTANE RATING.—77 (D.T.D. 224) minimum. Fuels containing tetra-ethyl-lead can be used.

THE 150 h.p. CIRRUS MAJOR SERIES II.

TYPE.—Four-cylinder in-line air-cooled inverted.

CYLINDERS.—Bore 4.72 in. (120 m/m.), Stroke 5.5 in. (140 m/m.), Capacity 383 cub. in. (6.3 litres), Compression ratio 5.8 : 1. Barrels are machined from high-grade steel ingots and are located in crank case by large spigot and four short studs securing cylinder base flange. Cylinder-heads are of aluminium-alloy with one inlet and one exhaust valve. Heads attached to barrels by twelve securing studs.

PISTONS.—Slipper type of Y-alloy, with two tapered compression and one scraper rings.

CONNECTING RODS.—Hiduminium forgings fitted with steel-backed white-metal bearings.

CRANKSHAFT.—Robust steel forging machined all over, carried in five plain bearings. Ball thrust-bearing at front end.

CRANKCASE.—Aluminium-alloy casting with Electron top-cover. The timing-gear cover at rear carries the auxiliaries and does not disturb any gears when removed as they are housed in the crank-case.

VALVE GEAR.—Operation, etc., as in Minor (Series I).

CARBURATION.—One Claudel-Hobson downdraught carburettor, fitted with flame-trap and direct cold air intake, and having an independent mixture control, is mounted on a one-piece cast induction manifold which is secured by bolts passing through bosses cast on the manifold and screwed into inserts in the cylinder-head. The cold air intake operates automatically at approximately 90% to full-throttle opening.

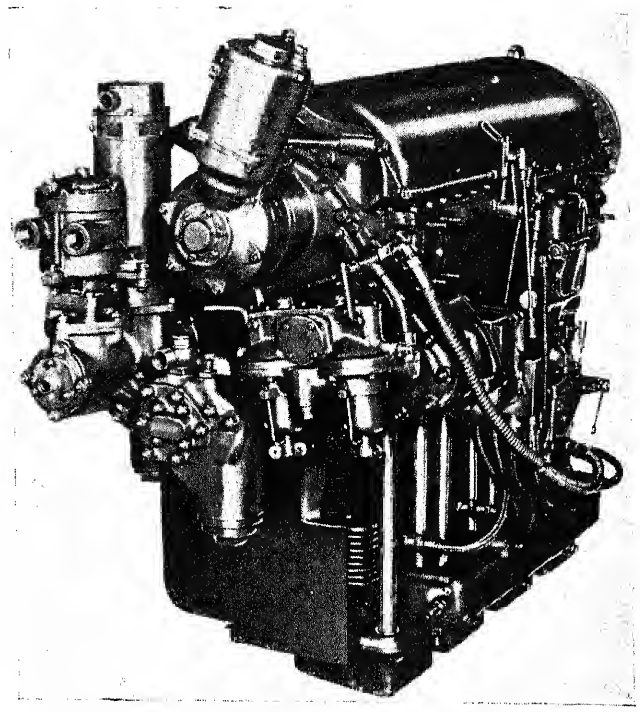
IGNITION.—Two B.T.H. magnetos one with impulse starter. K.L.G. sparking plugs. Screening can be provided if desired.

LUBRICATION.—Pressure feed system with scavenge pump. All oilways internal in crankcase casting. Pressure and scavenge filters embodied in the oil-pump which is of oscillating piston type.

AIRSCREW DRIVE. — Direct, left-hand tractor.

ACCESSORIES.—Optional. Amal Duplex fuel pump. Electric-starter vacuum pump, generator, and screening if required.

DIMENSIONS.—Overall length less spinner 42.9 in. (1,096 m/m.), Overall height 31.4 in. (797 m/m.), Overall width 17.3 in. (450 m/m.). Bearer feet bolt centres front to rear 21.25 in. (540 m/m.). Bearer feet bolt centres alternative widths 21.4 in. (544 m/m.), 18 in. (458 m/m.), 15.2 in. (386 m/m.).



A rear view of the Cirrus Major Series II or III Engine.

WEIGHT.—With airscrew hub 338 ± 5 lb. (153.4 kg. ± 2.3 kg.).

PERFORMANCE.—Normal 138 h.p. at 2,200 r.p.m.; maximum 150 h.p. at 2,450 r.p.m., Fuel consumption, full throttle at normal r.p.m., 10 Imp. gallons (45.46 litres) per hr., Cruising at 80% full power at 2,200 r.p.m., 7.3 Imp. gallons (33.2 litres) per hr., Oil consumption 0.75 to 2 pints per hr., (0.42-1.14 litres).

OCTANE RATING.—70 minimum. Fuels containing tetra-ethyl-lead can be used.

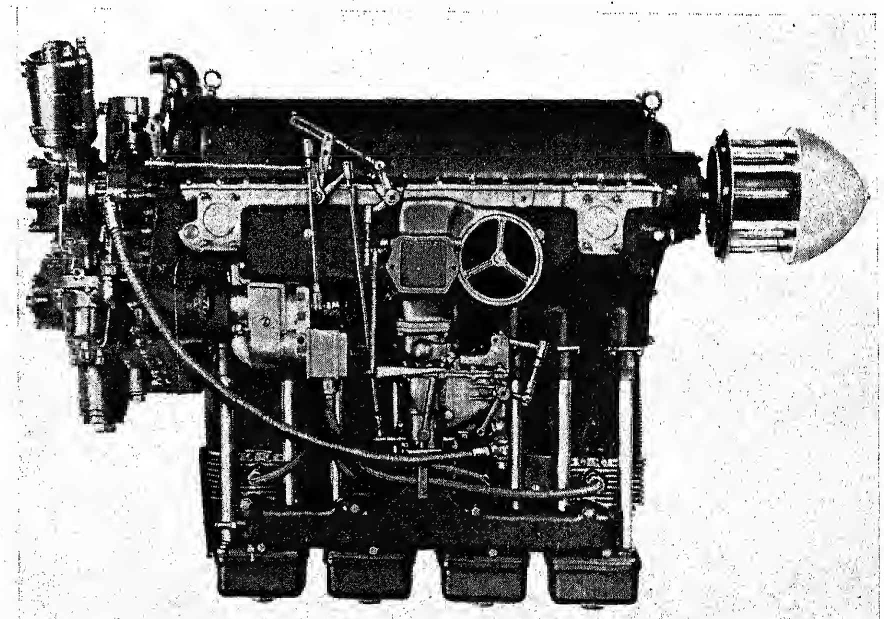
THE 145/155 h.p. CIRRUS MAJOR SERIES III.

The Cirrus Major Series III engine is similar in general arrangement to the Major Series II, but is a higher compression engine and has a correspondingly increased output. The Major Series II and Series III engines are alike in external appearances, and the illustrations may therefore be taken to represent both types. The description of the Major Series II engine will also apply to the Major Series III, except in the following details.

COMPRESSION RATIO.—6.5 : 1.

PERFORMANCE.—Normal 145 h.p. at 2,200 r.p.m., Maximum 155 h.p. at 2,450 r.p.m. Cruising 2,100 to 2,200 r.p.m., Fuel consumption full throttle at normal r.p.m., 10.5 Imp. gallons (47.7 litres) per hr., Cruising at 80% full power at 2,200 r.p.m., 8.2 Imp. gallons (37.3 litres) per hr., Oil consumption 0.75 to 2 pints (0.42 to 1.14 litres) per hr.

OCTANE RATING.—87 minimum. Fuels containing tetra-ethyl-lead can be used.



The 150 h.p. Cirrus Major Series II Engine.

DE HAVILLAND.

THE DE HAVILLAND ENGINE CO., LTD.

Head Office: Stonegrove, Edgware, Middlesex.

Directors: Major F. B. Halford (Chairman), Sir Geoffrey de Havilland, F. E. N. St. Barbe, A. S. Butler, J. L. Brodie, Hugh Buckingham and A.F. Burke (General Manager).

The de Havilland organization entered the aero-engine industry in 1927, when they produced the first of the Gipsy light aeroplane engine series.

The Gipsy range of engines has been designed by Major Frank B. Halford, F.R.Ae.S., M.S.A.E., working in close collaboration with the Design Department of the de Havilland Aircraft Company, Ltd.

The first experimental Gipsy engines, produced in July, 1927, were designed to develop 135 h.p. One was installed in the D.H. 71 Tiger Moth single-seat racing monoplane which established the then World's Speed Record for Light Aeroplanes at 186 m.p.h. (300 km.h.).

The most widely used engines in the Gipsy series, which were manufactured throughout the war, included the 130 h.p. Gipsy-Major I, the 200 h.p. Gipsy-Six I and the 205 h.p. Gipsy-Six II. For post-war use the company has developed a new series of four and six-cylinder engines brief details of which are published below.

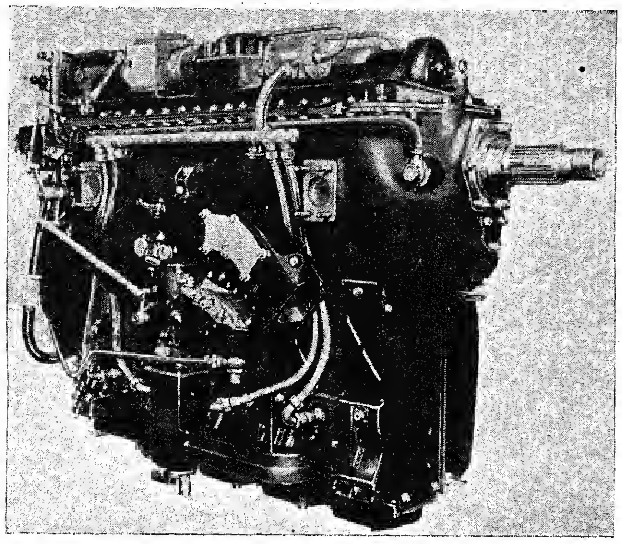
For the four-cylinder engines the name Gipsy Major is retained, but for the six-cylinder units the name Gipsy Six has been dropped in favour of the R.A.F. name Gipsy Queen, owing to the wide use of these engines under this name in the service during the war.

In the Gipsy Major Series there are two basic engines—the 160 h.p. Gipsy Major Series 30 and the 197 h.p. supercharged Gipsy Major Series 50. In the Gipsy Queen Series there are three engines—the 250 h.p. Gipsy Queen Series 30, the 295 h.p. supercharged Gipsy Queen Series 50, and the 330 h.p. geared and supercharged Gipsy Queen Series 70. All five engines will take controllable-pitch airscrews and the six-cylinder units will take a new constant-speed feathering and braking airscrew. The geared and supercharged Gipsy Queen Series 70 is fitted to the D.H. 104 Dove twin-engined light transport and the Miles M.60 Marathon four-engined feeder-type transport.

The new engines have a new cylinder of slightly greater bore and stroke, a 30% increase in fin area, and a new aluminium-alloy head with inserted valve seats. A standard piston is fitted giving a 6.5 : 1 compression ratio.

Most of the ignition equipment, apart from the distributors, is suitable for both four and six cylinder engines, are as the magnetos which incorporate an impulse starter. Many of the reciprocating and valve operating parts, joints, connections and small attachments are common throughout the series.

Strip-lined main bearings are fitted for improved performance, to enhance wear quality and to simplify replacement, while in the six-cylinder designs opportunity has been taken to stiffen the crankcase with a cross bolt through the centre journal cap and to apply a pendulum-type vibration absorber to a lightened crankshaft.



The 160 h.p. D.H. Gipsy Major Series 30 engine.

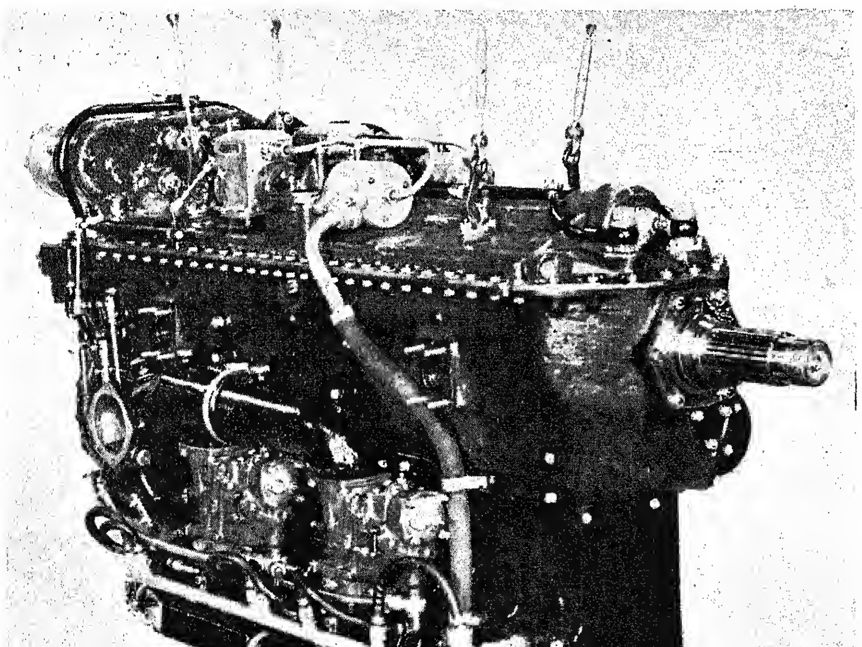
In the Gipsy Queen Series 70 a steel connecting-rod has been adopted and a Bibby-type coupling is used in conjunction with a self-centring epicyclic gear to give a smooth flexible reduction gear and a short compact gear casing.

In all engines provision has been made on the crankcase top cover to mount a variety of accessories. In the supercharged types the supercharger drive is taken from the front of the engine, in the case of the Gipsy Queen Series 70 through a long torsion shaft.

If required, the normally-aspirated engines can be converted to supercharged types by fitting the supercharger unit in place of the existing rear cover. Injection-type carburettors are a feature of the supercharged engines.

The de Havilland Engine Co., Ltd. entered the gas turbine field early in 1941. Design of the H-1 Goblin was started in April, 1941 and bench tests began a year later. Two H-1 units installed in a Gloster Meteor first flew on March 5, 1943. The Goblin is used to power the D.H. 100 Vampire single-seat jet-propelled fighter. A D.H. H-1 jet unit was also fitted to the prototype Lockheed XP-80 Shooting Star jet fighter. For details of the Goblin see pages 8-9d.

In 1934, the de Havilland Aircraft Co., Ltd., acquired the licence for the Hamilton-Standard controllable-pitch airscrew. The Company operates airscrew factories in Great Britain and Australia and manufactures airscrews in large quantities for the British and Dominion Governments.



The 250 h.p. D.H. Gipsy Queen Series 30 six-cylinder engine.

THE D.H. GIPSY QUEEN SERIES 30, 50 AND 70.

Type.—Six-cylinder in-line inverted air-cooled, direct-drive (Series 30), direct-drive supercharged (Series 50) or geared and supercharged (Series 70).

Cylinders.—Bore 4.73 in. (120 m/m.), Stroke 5.9 in. (150 m/m.), Swept volume 621 cub. in. (10,178 litres), Compression ratio 6.5 : 1. Standard Gipsy type cylinders machined from carbon-steel forgings and finned over three-quarters of length of barrel. To compensate for uneven expansion under working conditions, the cylinder bore is slightly tapered when cold, the smallest diameter being at the head end. This taper is so calculated that at normal operating temperatures the bore is parallel for all practical purposes. Aluminium-alloy head clamped to barrel and crankcase by four long steel studs. Moulded Dermatine ring between cylinder and crankcase and plain copper washer between barrel and head.

Pistons.—Fully-skirted of light alloy, with two compression and one scraper rings. Fully-floating gudgeon pins retained by washers and circlips.

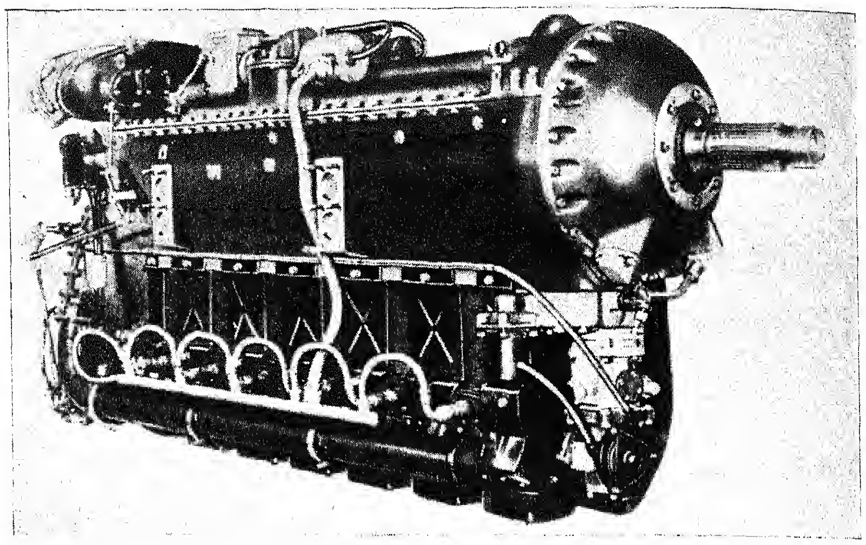
Connecting Rods (Series 30 and 50).—I-section aluminium-alloy forgings. Split big-ends with caps secured by four nickel-chrome bolts and split-pinned nuts. Unbushed little-ends drilled for lubrication.

Connecting Rods (Series 70).—I-section rods of nickel-chrome steel with Vandervell thin-wall big-end linings. Little-ends have floating phosphor-bronze bushes which are free both in connecting rod eye and gudgeon-pin.

DE HAVILLAND—*continued.*

Crankshaft.—Six-throw shaft is a nickel-chrome steel forging machined all over and is statically and dynamically balanced. Hollow crankpins and journals. Shaft runs on eight plain main bearings of normal split-type and lined with Vandervell thin-wall shells which consist of steel-strip backing approximately $\frac{3}{64}$ in. (1.18 m/m.) thick, lined with lead bronze on which a thin skin of lead is deposited. A thin film of indium is infused into the bearing surface. Thrust bearing is a single row ball-bearing capable of dealing with thrust in either direction.

Crankcase.—Aluminium-alloy main case stiffened by cross-webs which carry the main and camshaft bearings and additionally strengthened by a steel cross-bolt which passes through upper part of web and bearing cap of No. 4 main bearing. Rear wall and case closed by rear cover which extends below level of cylinder mounting face to form a sump, to underside of which oil-pump and pressure filter unit are bolted. Fuel pump mounted on port side of pump. In Series 50 and 70 supercharger replaces rear cover. Top cover is a magnesium-alloy casting and carries magnetos, distributors, vacuum pump, generator, air-compressor, constant-speed unit and their drives.



The 330 h.p. D.H. Gipsy Queen Series 70 geared and supercharged engine.

Valve Gear.—Standard Gipsy valve gear with two valves per cylinder operated by tappets and push-rods from hollow steel camshaft running in plain bearings in port side of crankcase. Both inlet and exhaust valve stems tipped with Stellite and head of exhaust valve and that portion of stem exposed to exhaust gases surfaced with Brightray to enhance resistance to leaded fuels. Sodium-cooled exhaust valves in Series 70.

Carburation (Series 30).—Pair of single-choke Hobson type A-1.55E downdraught carburettors each feeding three cylinders through separate three-branch manifold. Air intake contains hot and cold air intake shutter and flame trap.

Carburation (Series 50 and 70).—Hobson type D.H./G.1 injection carburettor metering fuel through an injection nozzle into the centre of the supercharger impeller.

Supercharger (Series 50).—Centrifugal type mounted in place of rear cover in Series 30. Single-sided impeller driven off rear end of camshaft through two compound intermediate gears. Complete gear train is situated between crankcase rear wall and supercharger front casing. Gear ratio 11.16 : 1.

Supercharger (Series 70).—Centrifugal type driven through two gear trains and a quillshaft which is co-axial with and passes through hollow camshaft. Gear ratio 11.22 : 1.

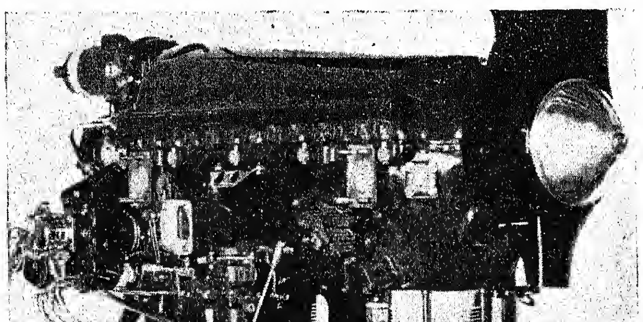
Ignition.—Two screened B.T.H. type C.G.A. or Rotax type N.G.A. magnetos and B.T.H. or Rotax distributors mounted on crankcase top cover and gear-driven off auxiliary drive shaft at $1\frac{1}{2}$ and $\frac{1}{2}$ times engine speed respectively. Two sparking-plugs per cylinder.

Lubrication.—Dry sump system. One pressure and two scavenge pumps with fabric type filter on pressure pump and gauze filters on suction side of all three pumps. Main bearings, big-ends and most bearings fed with oil under pressure. Pistons and cylinder walls sprayed with oil by jets from big-ends, supplemented by oil mist, and all other moving parts by oil mist or splash. Valves and rocker gear operate in oil baths. Worth oil-dilution system.

Accessories.—All accessories driven off rear of auxiliary drive shaft, each accessory coupled to its driving gear by splined coupling sleeve. Accessories include Rotax type N3EY or N3EM starter, Pesco B3 or B3X vacuum-pump, Rotax generator, Heywood SM6/2 air compressor and Lockheed Mk. V or VI hydraulic pump.

Cooling.—Standard system of air scoop and baffles.

Fuel.—Not inferior to 100 Octane except where lower compression ratio is obtained by fitting thicker cylinder-head washers.



The 145 h.p. D.H. Gipsy Major 10 engine.

Reduction Gear (Series 70).—Epicyclic gear driven off crankshaft through Bibby type flexible spring coupling. Gear ratio 0.711 : 1.

Airscrew.—Approved type of fixed-pitch wood or metal, or D.H. 2/1000/2 bracket type constant-speed (pitch range 14°) or D.H. 3/1000/2 Hydromatic type constant-speed, feathering and braking (pitch range 120° total, 25° constant-speed).

Dimensions, Weights and Performance.—See Table.

THE DE HAVILLAND GIPSY MAJOR 10.

Type.—Four-cylinder in-line inverted air-cooled.

Cylinders.—Bore 4.646 in. (118 m/m.), Stroke 5.512 in. (144 m/m.), Capacity 373.6 cub. in. (6.124 litres). Compression ratio 6 : 1. Barrels machined all over from forgings of carbon steel. Thickness of wall and depth of finning adjusted to ensure even cooling and prevent distortion. Exposed surfaces specially treated against corrosion. Ends project far into crankcase, with oil-tight joint of Dermatine between barrels and latter. Detachable heads of aluminium-alloy held by long H.T. steel studs to crankcase. Copper-asbestos washers beneath heads.

Pistons.—High-compression type machined from aluminium-alloy forgings. Fully-floating gudgeon pin located by external circlips and washers. One scraper and two compression rings below gudgeon pin.

Connecting Rods.—Machined all over from light-alloy stampings with split big-ends clamped together by four bolts and nuts. Big-end bearings of steel-backed white metal-lined type. Small end bearings unbushed.

Crankshaft.—Machined all over from nickel-chromium-alloy steel forging. Statically and dynamically balanced. Five steel-backed white-metal main bearings. Ball-bearing to take thrust at front end. Journals and pins bored for lightness and lubrication.

Crankcase.—Aluminium-alloy casting. Lower half carries the five main crankshaft bearings, which are held in position by separate caps. Top cover is of magnesium-alloy stoutly ribbed to resist deflection.

Valve Gear.—Fully enclosed. One inlet and one exhaust valve per cylinder. Valve seats, machined from nickel-chrome steel are shrunk and peened into roof of head, that for exhaust valve being also screwed in. Operation by steel rockers, tubular steel push-rods, and steel tappets off camshaft running in five bearings on port side of engine. All striking parts are hardened and replaceable. The camshaft is driven by spur-gears from rear end of crankshaft.

Induction.—Claudel-Hobson AI.48 downdraught carburettor supplies the engine, and up to highest cruising speed draws warmed air through flame-trap from the side of the engine. When the throttle is fully opened, an interconnected change-over flap is moved and air is taken from outside engine cowling. Thus freezing is prevented at cruising r.p.m. with no loss of performance at full throttle. Altitude control is provided by an air valve in the carburettor, operated from the cockpit.

Lubrication.—Oil is drawn from external tank by engine-driven gear-type pump on the rear of the engine, through a coarse gauze suction filter. This pump delivers at a pressure of 40 to 45 lbs. per sq. in., (2.81 to 3.16 kg./sq. c/m.) governed by an adjustable relief valve, to an Auto-Klean filter. Crankshaft, connecting-rods, camshaft and timing gear are pressure-fed from the main oilway, which is integral with the top cover. Cylinders are lubricated by special splash arrangements from connecting rod big-ends, whereby proper lubrication of pistons is established immediately on starting. Secondary external oil pipe lubricates all accessory drives and bearings on rear cover above crankshaft gear. Remaining gears and bearings in lower part of cover lubricated by splash oil from magneto gears and leakage past idler gear bushes which receive pressure oil from rear main bearings. Oil from rear cover and back of crankcase drains into settling tank and withdrawn by front scavenge pump. Oil drainage from wells, formed by projection of cylinders inside crankcase drawn from front end by rear scavenge pump through external pipe and filter box. Valve rocker gear lubricated separately by splash from rocker covers which are filled with oil to prescribed level.

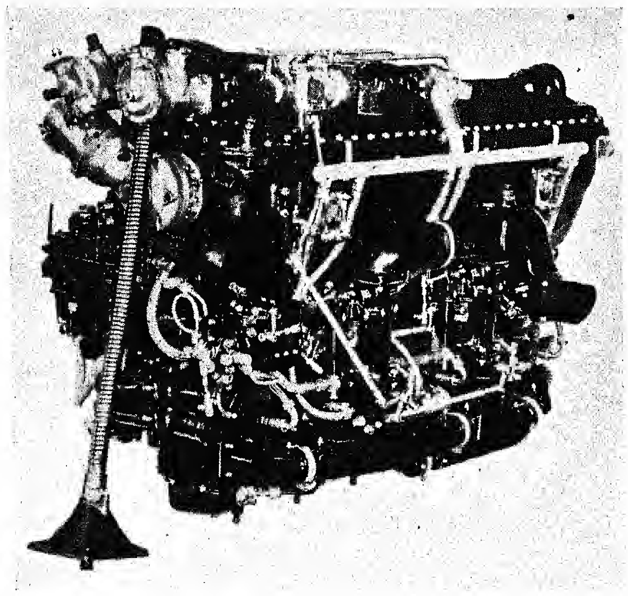
Cooling.—Scoops are fitted to the port side of the engine, for which suitable openings are arranged in the aircraft cowling. The air collected by these scoops is passed between the cylinders and heads and suitably deflected by special baffles on the starboard side of the engine.

DE HAVILLAND—*continued.*

IGNITION.—Two B.T.H. magnetos mounted in inverted position on either side of rear cover. Impulse starter coupling on starboard magneto.
AIRSCREW DRIVE.—Direct. Left-hand tractor. Provision for fixed-pitch wood or metal airscrew of approved design or D.H. manually-operated variable-pitch airscrew.
DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE DE HAVILLAND GIPSY QUEEN II.

TYPE.—Six-cylinder in-line inverted air-cooled.
CYLINDERS.—Bore 118 m/m. (4.646 in.), Stroke 140 m/m. (5.512 in.). Capacity 9.186 litres (560.6 cub. in.), Compression ratio 6 : 1. (See Gipsy Major 10).
PISTONS, CONNECTING RODS.—As Gipsy Major 10.
CRANKSHAFT.—Machined all over from E.S.C. forging of nickel-chromium-alloy steel drilled for lightness and lubrication. Balanced statically and dynamically. Runs in eight steel-backed white-metal main bearings. Ball thrust-bearing at front end.
CRANKCASE.—Electron. Small sump at back end. Each intermediate bearing supported by stiff cross-member with separate cap. Facings for bearer-feet, breather, fuel and oil pumps, tachometer drive and starter. Top cover of Elektron carries magnetos, distributors and driving gear.
VALVE GEAR.—Fully enclosed. One inlet and one exhaust valve per cylinder seat directly against aluminium-bronze of head. Driven by steel rockers, tubular steel push-rods, and hardened steel tappets off camshaft running in seven bearings on port side. All striking parts hardened and replaceable. Camshaft driven off front end of crankshaft by spur-gears. Camshaft gear attached to camshaft through vernier system of keyways to give accurate valve timing.
AUXILIARY DRIVES.—Camshaft and all auxiliaries driven off gear-wheel on front end of crankshaft between ball thrust-bearing and first crank-throw. Train of hardened gears with profile-ground teeth drive camshaft, and shaft in top cover running at 1.5 crank-shaft speed to drive magnetos. Fuel and oil pumps driven on vertical shaft at back end of camshaft. Tachometer drive and starter at back of crankcase.
CARBURATION.—Two Claudel-Hobson AI.48H.4M down-draught carburettors each supply three cylinders and up to highest cruising speed draw through a flame-trap warmed air from around cylinders. When throttle is fully opened a change-over flap is moved and air is taken from outside engine cowling. Thus freezing is prevented at cruising r.p.m. with no loss of performance at full throttle.
LUBRICATION.—Oil pump and filters form detachable unit at back of crankcase. Gear pump draws oil through coarse gauze filter from separate tank and delivers at 40 to 45 lbs. per sq. in. (2.8 to 3.16 kg./sq. c/m.) pressure by adjustable relief-valve to Auto-Klean filter. Main stream goes by way of cast passage in top cover to main bearings and thence to crankshaft. Oil thrown from holes drilled in big-end bearings and caps on to cylinder-walls and pistons.



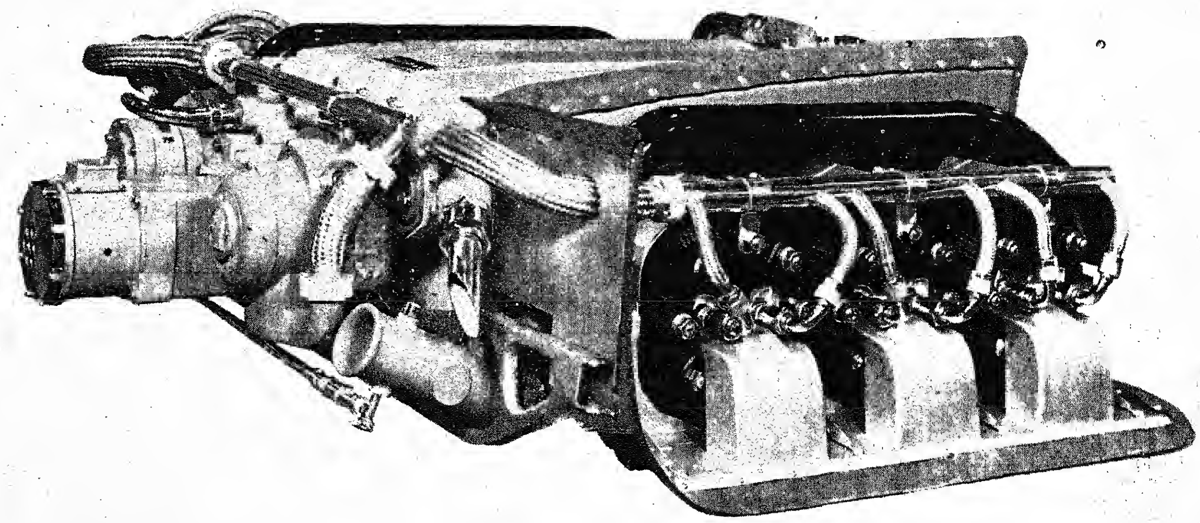
The 210 h.p. D.H. Gipsy Queen II six-cylinder engine.

Cams and tappets lubricated by spray. Other stream adjusted by balanced piston arrangement to 15 lbs. per sq. in. (1.05 kg./sq. c/m.) lubricates camshaft and other accessory drives. Two scavenge pumps, each with detachable fine-mesh gauze filter, draws oil from each end of crankcase. Except for connections to tank, there are no external oil pipes.
IGNITION.—Two B.T.H. type MC1-2 magnetos, each with improved impulse-starter and Simms flexible vernier coupling and each with separate distributor, each supply one plug per cylinder. Auto matic retarding for slow speed and starting.
COOLING.—As Gipsy Major 10.
STARTER.—Rotax Type N3-EY.
AIRSCREW DRIVE.—Direct. Left-hand tractor. D.H. fixed-pitch wood or metal manually-operated variable-pitch, or D.H. constant-speed bracket-type airscrew.
DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE D.H. GIPSY MAJOR AND GIPSY QUEEN ENGINES.

Name	Take-off Power	Inter-national Power Rating	Maximum Power Rating	Weight (dry)	Supercharger gear ratio	Airscrew gear ratio	Length (from C/L of airscrew over rear cover)	Width overall	Height overall
Gipsy Major Series 30	160 h.p. at 2,500 r.p.m. at sea level	156 h.p. at 2,400 r.p.m. at sea level	160 h.p. at 2,500 r.p.m. at sea level	340 lbs. (154.3 kg.) + 2½ % (includes cooling scoops, baffles and fuel pump unit)	—	—	(44.9 in.) 1,123 m/m.	(17.4 in.) 436 m/m.	(32.7 in.) 819 m/m.
Gipsy Major Series 50	197 h.p. at 2,500 r.p.m. at sea level	175 h.p. at 2,300 r.p.m. at 6,000 ft. (1,830 m.)	180 h.p. at 2,400 r.p.m. at 7,000 ft. (2,135 m.)	410 lbs. (186.1 kg.) + 2½% (as above)	11.16 : 1	—	(50.4 in.) 1,260 m/m.	(16.6 in.) 416 m/m.	(33.5 in.) 838 m/m.
Gipsy Queen Series 30	250 h.p. at 2,500 r.p.m. at sea level	245 h.p. at 2,400 r.p.m. at sea level	250 h.p. at 2,500 r.p.m. at sea level	510 lbs. (231.5 kg.) + 2½ % (as above)	—	—	(63.5 in.) 1,587 m/m.	(20.5 in.) 513.5 m/m.	(33.5 in.) 838 m/m.
Gipsy Queen Series 50	295 h.p. at 2,500 r.p.m. at sea level	260 h.p. at 2,300 r.p.m. at 6,000 ft. (1,830 m.)	270 h.p. at 2,400 r.p.m. at 7,000 ft. (2,135 m.)	560 lbs. (254.2 kg.) + 2½% (as above)	11.16 : 1	—	(65.5 in.) 1,638.5 m/m.	(19.2 in.) 480.5 m/m.	(42.2 in.) 1,056 m/m.
Gipsy Queen Series 70	330 h.p. at 2,800 r.p.m. at sea level	285 h.p. at 2,600 r.p.m. at 7,000 ft. (2,135 m.)	305 h.p. at 2,700 r.p.m. at 6,000 ft. (1,830 m.)	660 lbs. (300 kg.) + 2½% (as above)	11.22 : 1	.711 : 1	(71.5 in.) 1,787.75 m/m.	(17.3 in.) 433 m/m.	(33.9 in.) 847.75 m/m.
Gipsy Major 10	145 h.p. at 2,550 r.p.m. at sea level	136/142 h.p. at 2,400 r.p.m. at sea level	145 h.p. at 2,550 r.p.m. at sea level	312 lbs. (142.6 kg.) + 2½% (as above)	—	—	(48.3 in.) 1,227 m/m.	(20 in.) 508 m/m.	(29.6 in.) 752 m/m.
Gipsy Queen II	200/210 h.p. at 2,400 r.p.m. at sea level	200/210 h.p. at 2,400 r.p.m. at sea level	210 h.p. at 2,400 r.p.m. at sea level	508 lbs. (230.6 kg.) less airscrew and starter	—	—	(58.4 in.) 1,454 m/m.	(18.5 in.) 482 m/m.	(32.9 in.) 838 m/m.

FEDDEN.



The 185 h.p. Fedden six-cylinder horizontally-opposed sleeve-valve engine.

ROY FEDDEN, LTD.

Head Office and Works: Stoke Orchard, near Cheltenham, Glos.

Roy Fedden, Ltd. was formed by Sir Roy Fedden and associates in 1945 to specialize in the design and development of low-drag power-units for small and medium-sized aircraft.

The company's first two engines, which will be undergoing development early in 1947, are a 1,350 h.p. propeller gas turbine and a flat-six air-cooled piston engine for fully-submerged mounting within the wings of light multi-engined aircraft. Preliminary details of the gas turbine, which is being developed to the requirements of the Ministry of Supply, will be found on page 9d. Details of the Fedden flat-six piston engine follow.

THE FEDDEN FLAT-SIX.

Type.—Six-cylinder horizontally-opposed sleeve-valve air-cooled unsupercharged.

Cylinders.—Bore 4.3 in. (109.2 m/m.), Stroke 3.75 in. (95.25 m/m.), Capacity 325 cub. in. (5.3 litres), Compression ratio 8.0 : 1. Barrels of low-expansion silicon alloy. Three inlet and two exhaust ports per cylinder.

Sleeves.—Nickel manganese chromium-alloy high-expansion steel.

Crankcase.—Two-piece aluminium.

Crankshaft.—Six-throw one-piece shaft supported in four plain bearings and fitted with adaptor to take extended drive shaft.

Fuel System.—Direct injection.

Ignition.—Single magneto. One coil and distributor. Two sparking-plugs per cylinder. Shielded wiring.

Lubrication.—Pressure (80 lbs./sq. in. = 5.625 kg./sq. c/m.).

Starter.—Combined starter motor and generator coupled direct to crankshaft.

Dimensions.—Width (across cylinder head) 31.7 in. (805 m/m)., Length (from end of starter motor to joint face between engine and drive shaft or torque tube) 35.6 in. (905 m/m.), Length (without starter) 30.25 in. (769 m/m.), Height overall 14.75 in. (375 m/m.).

Dry Weight.—310 lbs. (140.7 kg.) without starter-generator, reduction gear, exhaust system or baffles.

Performance (Ungeared).—Take-off power 160 h.p. at 2,750 r.p.m., Cruising output 123 h.p. at 2,500 r.p.m.

Performance (Geared).—Take-off power 185 h.p. at 3,400 engine r.p.m., Cruising output 150 h.p. at 3,150 engine r.p.m.

MONACO.

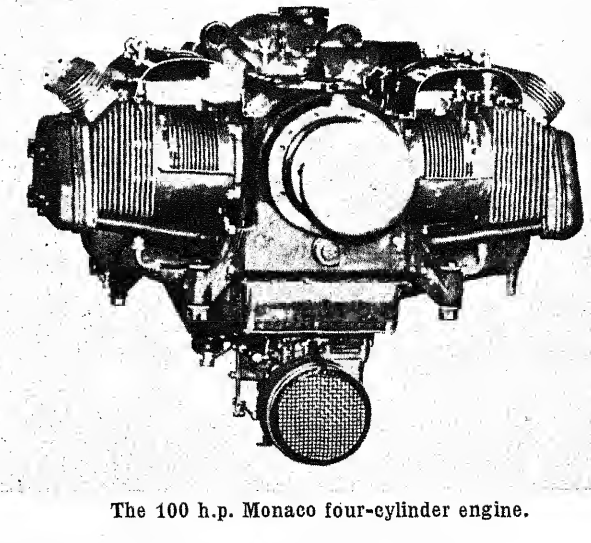
MONACO MOTOR AND ENGINEERING CO., LTD.

Head Office and Works: High Street, Watford.

Directors: P. R. Monkhouse and I. F. Connell.

The Monaco Motor and Engineering Co. Ltd. was formed in 1935 and up to the outbreak of the last war was concerned only with automobile engineering. During the war it undertook sub-contract work for aircraft and aero-engine manufacturers under the auspices of the Ministry of Aircraft Production.

It has now entered the aero-engine field with a new four-cylinder horizontally-opposed air-cooled engine suitable for light aircraft. Two versions of this engine, rated at 75 h.p. and 100 h.p., will be available and there will be three basic types of each; Sport, De Luxe and Wing; the last-mentioned being fitted with an airscrew shaft extension with cush-drive for wing-mounting. All models will be adaptable for pusher installation or for driving helicopter rotors.



The 100 h.p. Monaco four-cylinder engine.

THE MONACO FOUR-CYLINDER ENGINE.

Type.—Four-cylinder horizontally-opposed air-cooled.

Cylinders.—Bore $4\frac{3}{8}$ in. (111.2 m/m.), Stroke $3\frac{5}{8}$ in. (92 m/m.), Capacity 218 cub. in. (3.6 litres), Compression ratio 6 : 1. Separate cylinder barrels and detachable heads of light alloy.

Pistons.—Aluminium-alloy castings with high radial-pressure-hardened (700 Brinnell) piston rings. Tubular gudgeon-pins secured by circlips.

Connecting Rods.—Light alloy forgings.

Crankshaft.—Machined from solid steel forging.

Crankcase.—One-piece barrel-type Elektron casting. Inspection cover on top of case.

Valve Gear.—Overhead. Zero-lash hydraulic tappets, eliminating valve adjustment and giving silent operation.

Carburation.—Hobson AV.46 updraught carburetter with hot and cold air intake and flame-trap. Inlet manifold cast integrally with sump and submerged in oil to give improved vaporisation of fuel and additional cooling of lubrication oil.

Ignition.—Duplex B.T.H. magneto firing two plugs per cylinder.

Lubrication.—Air-cooled wet sump with oil level tell-tale and Auto-klean automatic or manually-cleanable pressure oil filter. Gear pump and pressure lubrication. Magnetic oil drain plug.

Mounting.—Universal bearer feet with rubber bushings. Engine can be mounted at rear end only or on cantilever bearers.

Cowling.—Cowling and baffles supplied with engine.

Airscrew Drive.—Direct. Left-hand tractor. Fixed-pitch airscrew hub B.E.S.A. No. 1 size. Variable-pitch airscrew optional.

Dimensions.—Overall length $38\frac{3}{4}$ in. (982 m/m.), Height $27\frac{7}{8}$ in. (707 m/m.), Overall width $32\frac{5}{16}$ in. (823 m/m.).

Dry Weight (Sport type).—230 lbs. (104.4 kg.) including all accessories, petrol pipes and exhaust pipes, etc., but not airscrew hub.

Performance (75 h.p. model).—Take-off power 75 h.p. at 2,200 r.p.m. (fixed-pitch airscrew) or 80 h.p. at 2,350 r.p.m. (variable-pitch airscrew), International rating 80 h.p. at 2,350 r.p.m. maximum level, 70 h.p. at 2,050 r.p.m. maximum climb and 65 h.p. at 1,900 r.p.m. normal cruising, Fuel consumption 4.06 Imp. gallons (18.5 litres) per hour maximum, 3.85 Imp. gallons (17.5 litres) per hour cruising.

Performance (100 h.p. model).—Take-off power 100 h.p. at 2,800 r.p.m. (fixed or variable-pitch airscrew), Estimated maximum

MONACO—continued.

power (6 : 1 compression ratio) 135 h.p. at 4,000 engine r.p.m., International rating 104 h.p. at 2,900 r.p.m. maximum level, 93 h.p. at 2,600 r.p.m. maximum climb and 80 h.p. at 2,350 r.p.m. normal cruising, Fuel consumption 5.42 Imp. gallons (24.6 litres) per hour maximum 5 Imp. gallons (22.7 litres) per hour cruising.

The above description applies to the standard Sport Type. In the De Luxe Type any or all of the following equipment can be fitted:—Shrouded ignition cables, air-cleaner, air-intake thermometer, ice-guard, silencer, cabin-heater, mechanical variable-pitch airscrew, generator, starter (hand or electric), vacuum-pump, air-compressor, fuel injection, Kigass primer, reduction-gear, hydraulic pump, dry-sump system of lubrication, oil-cooler, helicopter drive adaptation, etc. The Wing Type is the same as the Sport Type but is fitted with an airscrew shaft extension assembly with Monaco cush-drive for wing mounting in small multi-engined aircraft. Either tractor or pusher installations may be supplied.

NAPIER.

D. NAPIER & SON, LTD.

Head Office and Works : Acton, London, W.3.

Established : 1808. Incorporated in 1913.

Chairman : Sir George H. Nelson.

Managing Director : H. G. Nelson.

D. Napier & Son, Ltd. entered the aero-engine industry during the war of 1914-18, beginning by building engines of official design. The company's first original product, the Lion eighteen-cylinder W-type liquid-cooled aero-engine, was produced in 1918 and quickly established an enviable reputation for reliability. For fifteen years a marine version of the Lion, known as the Sea-Lion, gave excellent service in high-speed rescue launches and other marine craft.

In 1927 the Napier Company commenced a new line of development in aero-engine design, namely, that of the air-cooled double-crank in-line engine. This resulted in the successful Rapier and Dagger series, which were both H-type engines, the Rapier, with sixteen cylinders, giving a maximum output of 395 h.p., and the Dagger, with twenty-four cylinders, developing a maximum output of 1,000 h.p.

Towards the end of 1935, it was decided, from the experience gained with the Rapier and Dagger, to design and build a 2,000 h.p. engine. Napiers subsequently produced the well-known Sabre engine, which was destined to play a leading part in the late War.

The Sabre was a further step in the development of the twin crankshaft aero-engine and incorporated certain changes in design. Unlike the previous Napier H-type engines, the Sabre is a horizontal twenty-four cylinder I type, is liquid-cooled, and has reciprocating single sleeve-valves in place of the former poppet valve system. It passed the Air Ministry 100-hour type test in June, 1940, with a maximum power output of 2,050 h.p. at 3,700 r.p.m. The Sabre II became the standard power-plant of the Hawker Typhoon and Tempest V.

The Sabre II has now been superseded by the Sabre VA which forms the power unit for the Hawker Tempest VI. It embodies a number of major improvements over the II, and is not merely a modified version of this engine. The Sabre VII is similar to the VA, but employs methanol/water injection. This engine is installed in the Hawker Fury I single-seat fighter.

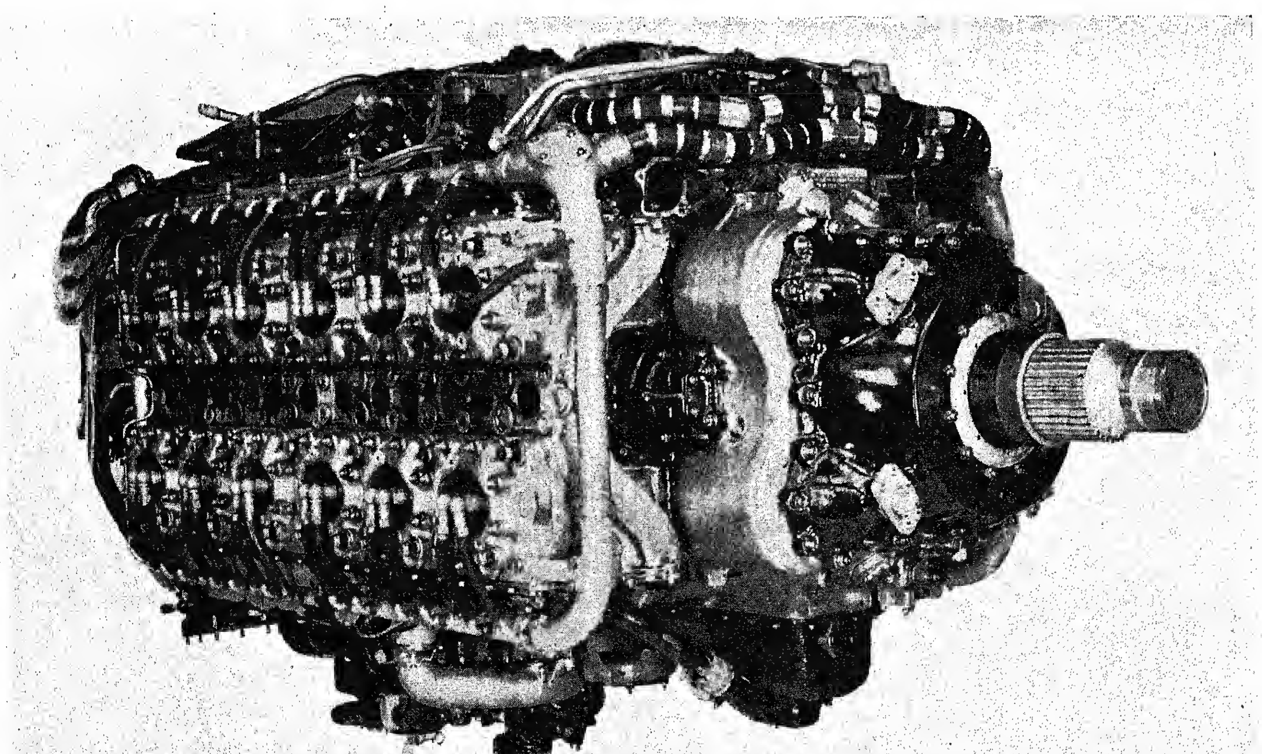
THE NAPIER SABRE VA.

Type.—Twenty-four-cylinder I type four-stroke, sleeve-valve liquid-cooled, with two-speed supercharger.

Cylinders.—Bore 5 in. (127 m/m.), Stroke 4.75 in. (121 m/m.), Total swept volume 2,238 cub. in. (36.7 litres), Compression ratio 7 : 1. Top cylinders in each block are numbered 1-12 commencing rear left and moving in clockwise direction round to rear right. Bottom cylinders numbered likewise. Cylinders for each cast light-alloy block are bored in two banks of six, the blocks being secured to port and starboard sides of crankcase by studs and tie bolts. Each bank of six has a separate induction manifold secured to facing in the block. Twelve jacketed passages lead from the exhaust ports to the facing, positioned between the two banks of cylinder heads, to connect with six ejector type exhaust stubs attached to facing. Each cylinder has three inlet and two exhaust ports. No. 2 inlet port is directly facing the induction manifold, the others being disposed around the cylinder. Priming jet fitted to No. 2 inlet port of each cylinder on the two lower banks and to cylinders 4, 5, 8 and 9 on top banks. These jets are connected by ducts to the priming pipes which are positioned alongside each induction manifold. Coolant jackets for the cylinders are embodied in the castings and each induction manifold incorporates a coolant inlet and outlet gallery, the inlet gallery being outermost. A central vertical channel in each block connects the two inlet galleries, and a curved passage, cast in the front of each block, connects the two outlet galleries. The joint facing of each block is grooved along the centre line to accommodate the sleeve-drive worm-shaft. Low-pressure oil gallery bored in the casting communicates oil to the worm-shaft bearings. Accommodated in the base of each cylinder is a sleeve scraper ring assembly which consists of a wedge-action scraper ring, an inner ring, and steel spring, all housed in a bronze cage. The feet of the pedestal bearings slightly overlap to retain the scraper ring assemblies.

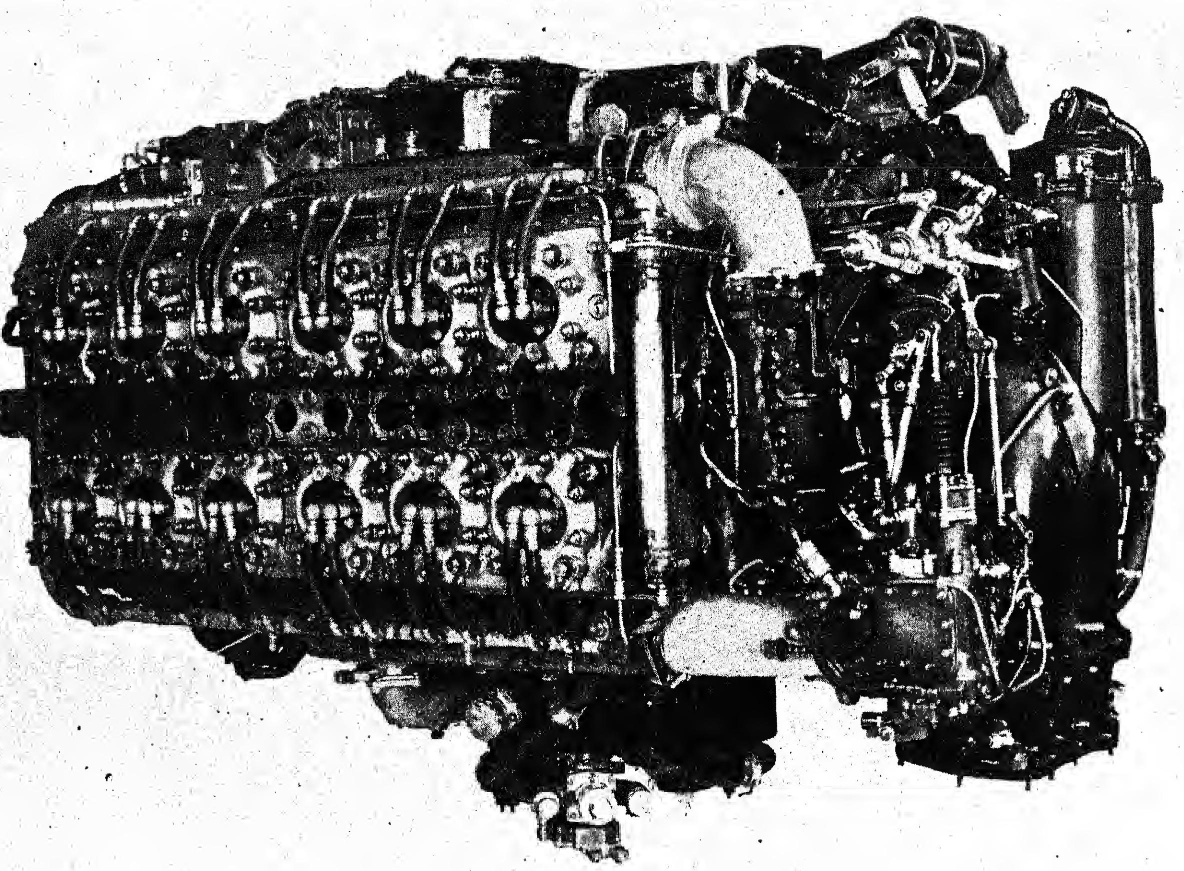
Cylinder Heads.—The cylinder heads are separate light alloy castings with coolant jacketing. Each head provided with a gas compression ring and two bronze sparking plug adaptors. The head is attached to the cylinder block by seven short cylinder-head studs and two of the long crankcase studs, an intervening rubber composition ring serving to provide a gas-tight joint. Two inlet and two outlet coolant transfer holes are located in the flange and are each sealed with a rubber composition ring.

Sleeve.—Each cylinder is fitted with a movable sleeve in which are two inlet, one exhaust, and one combined inlet exhaust port. The combined port is of an irregular four-sided shape, while the other three are roughly triangular. A driving pin is embodied in each sleeve which is strengthened locally at the inner ends. The sleeves are driven in pairs from a common crank. The sleeve



Three-quarter front view of the 2,310 h.p. Napier Sabre VA engine.

***NAPIER**—continued.*



Three-quarter rear view of the 2,310 h.p. Napier Sabre VA twenty-four-cylinder sleeve-valve liquid-cooled engine.

in the lower bank rotates in the opposite direction to that in the upper bank and in consequence is slightly different in construction. Fifteen shallow oil grooves, located internally at the inner end of each sleeve, are for the ejection of excess oil from the inside. The scraper ring in the base of the cylinder prevents an excessive amount of oil being carried up the outside of the sleeve.

SLEEVE DRIVE.—A hollow sleeve-drive worm-shaft runs in fifteen Vandervell bearings and is positioned longitudinally on the inner face of each cylinder block. Each shaft is constructed from two halves joined by a sleeve-type flanged coupling. The shaft is driven at crankshaft speed by a spur gear, which is pinned to a flange at the front of the shaft and meshes with the appropriate upper reduction gear through an idler. Machined integrally on the shaft are six worm-gears, each driving, through a crank and worm-wheel assembly, one upper and one lower cylinder bank sleeve. Journal surfaces are provided on either side of the worm wheels and thrust flanges are formed integrally with the shaft. The front end of the shaft is splined internally to receive the correspondingly splined end of the torsion shaft which is positioned centrally throughout the worm-shaft. This torsion shaft, together with the one similarly housed in the other sleeve-drive worm-shaft, provides the drive for the supercharger impeller. Lubrication of the assembly is effected by the low-pressure system.

PISTONS.—Machined from light alloy with flat tops. Two grooves in the top part of the skirt accommodate the compression ring and compression-cum-scraper rings, the former being uppermost. A third groove round the lower part of the skirt accommodates a duplex wedge-action scraper ring consisting of separate inner and outer rings which bed down together. The floating hollow gudgeon pins are retained by circlips and intervening thrust washers.

CONNECTING RODS.—Steel I-section forked and plain rods assembled in horizontally-opposed pairs, and a common Vandervell bearing dowelled to the caps of the forked rod, the plain rod oscillating on the outer surface of the bearing. Each bearing lubricated by pressure oil supplied to the bored crankshaft from the galleries in the crankcase. Caps secured to rods by bolts locked against rotation and drawn up with split-pinned castle nuts. The small end of each rod is lined with a dowelled phosphor bronze bush, and is lubricated by splash oil only.

CRANKSHAFT.—Twin crankshafts, positioned one above the other, of conventional 120 degrees six-throw design with seven journals. They are interchangeable and so timed that corresponding crankpins on both shafts reach T.D.C. together. Crankpins and journals bored out and crankwebs drilled to provide oil passages. Bores of crankpins and journals are sealed with conical plug and bolt assemblies. A spur pinion is shrunk and keyed on the front end of the shaft and is further secured thereto by a large hexagonal ring nut and tongued locking ring. The starter-driven gear is bolted to the rear flange of the upper crankshaft.

CRANKCASE.—Light alloy casting in two halves, joined along mid-vertical line of engine. Castings strengthened by five substantial cross webs and front and rear bulkheads, which are machined to provide seven housings for the crankshaft journal bearings. A front extension of the crankcase partly houses the reduction gearing, and a rear extension partly houses the starter gear idler. Halves assembled on six studded faces as follows on either side for the two cylinder blocks; on the rear for the supercharger casing; on the front for the front cover unit, above and below for the top and bottom cover units. Four smaller faces on underside for engine-mounting feet. Eye bolts anchored in casing for slinging. Oil galleries in crankcase communicate oil to crankshaft journals; to lubricating jets in front cover unit, and to balance arm assemblies. Passages also provided for the operating oil circuits to top cover accessories. Holes and channels in casing assist drainage of scavenge oil.

FRONT COVER UNIT.—Reduction gearing in crankcase front extension is disposed symmetrically about the upper and lower crankshaft pinions to give a reduced speed of 1 : 0.2472 relative to crankshaft. Airscrew shaft located axially by the rear centre bearing in the crankcase, the journal and thrust loads being taken by the front roller-bearing and ball-bearing respectively. These bearings are housed together in the front aperture of the airscrew shaft cover. The airscrew shaft cover is forwardly dished, and shaped and bossed internally to accommodate balance arm assemblies. The front bearing housing, oil seal cover, and saddle tank support ring are secured successively to the faced aperture at the front of the cover. Cover secured to studded facing of crankcase by studs and nuts; and intervening gear carrier houses the front bearings of the reduction gear layshafts and allows cover to be removed completely without disturbing gears. A support plate, in bridge form, is attached to the gear carrier and houses the front bushes for the two sleeve-drive idler gear layshafts. The compound reduction gears comprise, four diagonally-opposed helical gears which mesh with airscrew shaft gear, and four large spur gears mounted on integral layshafts of the helical gears to mesh with crankshaft pinions. The sleeve-drive idler gears, positioned slightly above the mid-horizontal line of the engine, mesh with the appropriate upper spur gear. A hydromatic bearing is housed within the rear bearing of the propeller shaft to connect with the oil passages in the shaft bore whence oil is communicated to the propeller mechanism. Lubrication by jets which direct high pressure oil on to teeth as they come into mesh.

CARBURATION.—A special Hobson type N.S.4 injector on left side of the intake bend of the supercharger. The injector incorporates the fuel metering valve, accelerator pump, pressure regulating valve, and automatic boost and altitude controls. Fuel supplied to a nozzle, the tip of which enters a spinner on the impeller eye. Spinner gives a multi-spray into the impeller vanes.

FUEL PUMP.—The fuel is supplied to the injector by a vane-type Pesco pump bolted to underside of sump with a composition distance piece to insulate the pump against heat. A relief valve embodied in the pump is differentially controlled to allow for variations in atmospheric pressure.

SUPERCHARGER.—Hydraulically-operated two-speed single-entry centrifugal type. Gear ratios 4.68 : 1 (low), 5.83 : 1 (high). Inside supercharger casing and between impeller and crankcase is the change-speed clutch. From the impeller the mixture passes through a ring of fixed diffuser blades and thence to four volutes cast in the casing. Each volute supplies the appropriate cylinder bank through its induction manifold. Volutes positioned above and below the top and bottom banks respectively.

NAPIER—continued.

Lubrication.—High-pressure oil system circulating to main journal bearings, big-end bearings, airscrew shaft rear bearing, balance arms and supercharger layshafts, and by jets on to main reduction gears. Sleeves and gudgeon-pins lubricated by splash. High-pressure oil is passed through reducing valves to provide a low-pressure system which is communicated to the sleeve and auxiliary-drives. Metered oil supplied to supercharger impeller rear bearing. Front scavenge pump delivers oil from bottom cover casing to sump, whence it is returned to the supply tank by the main scavenge pump. A pressure relief valve is incorporated in the high pressure system. One pressure pump and two scavenge pumps, all of the gear type are fitted and are situated in the bottom cover unit. A Vokes felt-element filter incorporated in pressure system and gauze-type filters employed for scavenge system.

Ignition.—Two B.T.H. type C2/SE-ES/1 duplex magnetos mounted opposite each other on the top cover and driven by auxiliary drive shaft, and two B.T.H. type C.D.H.12/12 S.4/4 distributors similarly mounted and driven. Each cylinder provided with a leading and a rear sparking plug; the left-hand magneto energizes the left-hand distributor which supplies the twenty-four leading plugs, while the right-hand magneto and distributor supply the twenty-four rear plugs. Automatic advance and retard of the ignition provided by a servo-control unit. Ignition advance and retard by both boost pressure and engine r.p.m.

Auxiliary Drives.—Top cover forms a detachable unit and houses the main shaft drive and auxiliary gear drives for the units mounted on it. The main shaft drive is driven from the upper crankshaft pinion *via* an idler gear. Accessories on top cover include the duplex magnetos and distributors, ignition servo-control unit, airscrew governor unit, air compressors, vacuum pump, supercharger oil metering pump, electric generator, and hydraulic pump which is driven from the right-angle drive unit. Lower auxiliary drive shaft driven by lower crankshaft through an idler gear. Driven from this shaft, through suitable gearing, are two coolant pumps, main and front scavenge pump, pressure oil pump, and fuel pump.

Coolant System.—Pressure type, operating with a 30-70% Ethylene-Glycol mixture. The coolant flows from the pumps into the engine whence it branches to the upper and lower cylinder banks. In each case it circulates round the cylinder heads, passes to the cylinder barrels and exhaust ports and thence to a collector gallery. From this gallery the coolant flows to an outlet connection, at the front of the engine, from which it passes to a ring-type header tank in the nose of the cowling. From the ring-tank it flows *via* the radiator back to the pumps.

Starter.—Coffman type L.4S cartridge starter, which drives on to the upper chankshaft rear pinion through an idler gear, mounted on top of crankcase aft of top cover unit.

Controls.—Airscrew and throttle controls interconnected and operated by throttle control in cockpit with override device, allowing independent control of airscrew and throttles for ground testing and for certain conditions of flight.

Nett Dry Weight.—2,500 lbs. (1,134 kg.).

Dimensions.—Overall length 82.25 in. (2,089 m/m.), Overall width 40 in. (1,016 m/m.), Overall height 46 in. (1,168 m/m.).

Performance.—Maximum take-off power 2,310 h.p. at 3,850 r.p.m. at sea level (moderate supercharge), International rating 2,200 h.p. at 3,650 r.p.m. at 6,750 ft. (2,060 m.) (moderate supercharge), 1,970 h.p. at 3,650 r.p.m. at 1,700 ft. (520 m.) (full supercharge), Combat rating 2,615 h.p. at 3,850 r.p.m. at 2,500 ft. (760 m.) (moderate supercharge), 2,315 h.p. at 3,850 r.p.m. at 13,750 ft. (4,190 m.) (full supercharge.

THE NAPIER SABRE VI.

The Sabre VI is basically a Series VA engine with modifications to suit its installation behind an annular nose radiator with engine-driven cooling fan.

THE NAPIER SABRE VII.

The Sabre VII is in general similar to the Series VA except that water/methanol injection is used to obtain high powers for take-off and combat conditions. Certain components have been strengthened to enable them to stand up to increased loads. The controls have been modified to suit the altered boost pressures and speeds, and to ensure that the water/methanol cannot be used except under the appropriate conditions.

Dimensions.—Overall length 83 in. (2,105 m/m.), Overall width 40 in. (1,016 m/m.), Overall height 47.25 in. (1,189 m/m.).

Nett Dry Weight.—2,540 lbs. (1,152 kg.).

Performance.—Take-off 3,000 h.p. at 3,850 r.p.m. at sea level, Climbing 2,235 h.p. at 3,700 r.p.m. at 8,500 ft. (2,590 m.) (moderate supercharge), 1,960 h.p. at 3,700 r.p.m. at 18,250 ft. (5,560 m.) (full supercharge), Combat 3,055 h.p. at 3,850 r.p.m. at 2,250 ft. (685 m.) (moderate supercharge), 2,760 h.p. at 12,500 ft. (3,810 m.) (full supercharge).

NUFFIELD.

THE NUFFIELD ORGANISATION, ENGINE BRANCH.

Head Office: Cowley, Oxford.

The Engine Branch of the Nuffield Organisation has under development a small four-cylinder horizontally-opposed air-cooled engine suitable for light personal aircraft. The Nuffield unit has a bore and stroke of 4.375 in. × 3.875 in. (111 m/m. × 98.4 m/m.) and a capacity of 3.82 litres (233 cub. in.). With a compression ratio of 6.3 : 1 the engine will develop a maximum output of 100 h.p. at 2,600 r.p.m. The designed cruising power is 70 h.p. at 2,300 r.p.m.

The principal features of the Nuffield engine include overhead valves; large cooling area of cylinders, heads and crankcase sump; direct-drive with provision for either tractor or pusher propeller; updraught carburetter; dual ignition; 12-volt electrical system with gear-driven dynamo and an integral pre-engagement type starter motor. Manually-operated altitude control will be standard but automatic operation will be available optionally. An automatic control of warm and cold air to the carburetter is being investigated and at a later stage direct fuel-injection may be developed.

ROLLS-ROYCE.

ROLLS-ROYCE, LTD.

Head Office: Derby

Works: Derby, Crewe and Glasgow.

London Office: 14-15, Conduit Street, W.1.

Established: March 15, 1906.

Chairman: Capt. E. C. Eric Smith, M.C.

Managing Director: E. W. Hives, C.H., M.B.E.

Chief Engineer: A. G. Elliott, C.B.E.

Other Directors: Harald Peake, M.A. and W. T. Gill, C.A. (Financial).

Rolls-Royce, Ltd. specialises in the production of high-performance liquid-cooled aero-engines for both civil and military aircraft.

During the war over 150,000 Rolls-Royce Merlin engines were built in Great Britain and the U.S.A. In 1943 the combined Derby, Crewe and Glasgow factories reached an output of 18,000, or nine times the 1939 figure. The Griffon engine has also been produced in large quantities.

In the experimental field the company has examined the possibilities of air-cooling and sleeve valves, two-stroke and compression ignition engines, as well as direct fuel-injection. Engines incorporating these features were designed, built and tested at Derby during the war. One of these engines was the Eagle, a twenty-four-cylinder H-type sleeve-valve engine, but owing to the need for concentration on the production and development of the Merlin and Griffon engines, its development was necessarily held back. With the end of the war work on the Eagle was intensified and it is now undergoing flying trials. A brief description follows.

Since the end of the war Rolls-Royce have developed a series of engines for civil transport. This range of engines started with the Merlin 102 which was the first engine to complete successfully the British Air Registration Board's type-test requirements for civil aero-engines. The Merlin 102 engine powered the prototype Avro Tudor I and Tudor II but the production Tudor I and II will be fitted with the Merlin 621, a similar engine to this being the Merlin 620 which has already been installed in the Douglas DC-4M forty-passenger airliner, a fleet of which will be operated by Trans-Canada Air Lines. These engines incorporate the wealth of experience gained by Rolls-Royce throughout the war years.

The Rolls-Royce Company has also been outstandingly successful in the development of the gas-turbine engine for aircraft propulsion. The Gloster Meteor, the first and only allied jet-propelled fighter to go into operational service in the European War, and also the holder of the World's Speed Record, is fitted with two Rolls-Royce Derwent engines. A later engine, namely the Nene, has even greater power than the Derwent. It has been installed in the American Lockheed P-80 and the D.H. Vampire, and its latest application is in a Lancastrian which has two Nene engines outboard and two Merlin engines inboard. Further commercial installations of Rolls-Royce gas-turbines are under development. Details of Rolls-Royce gas-turbine engines will be found on pages 11-13d.

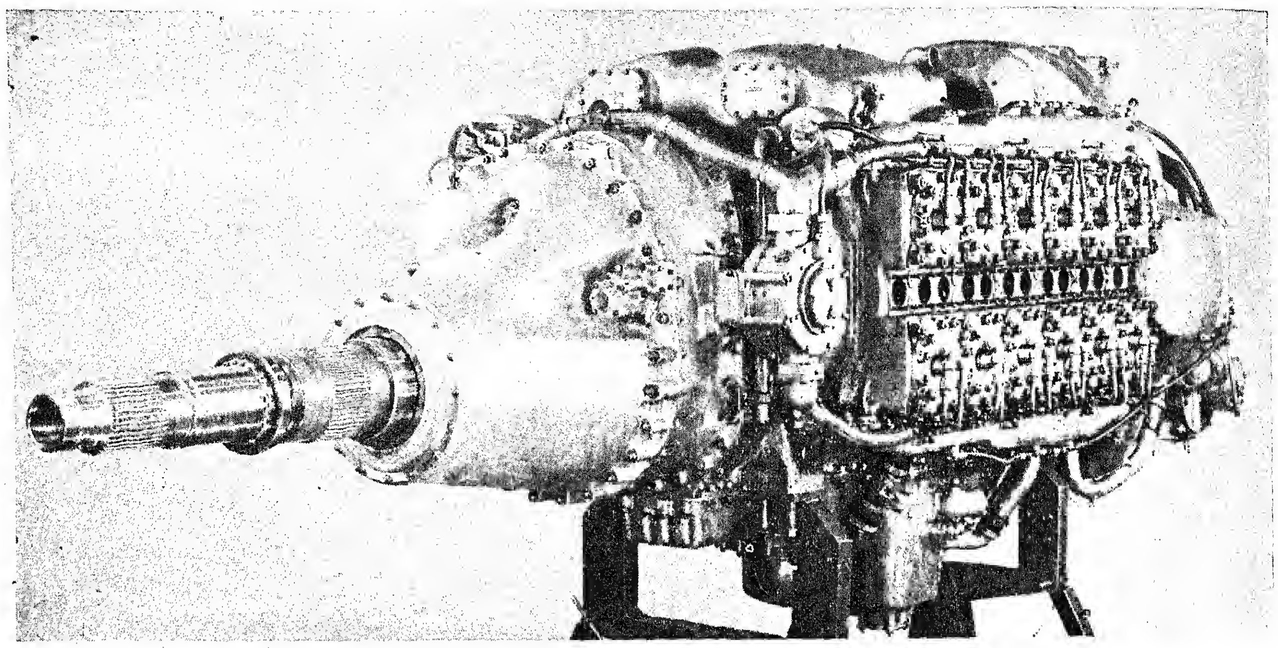
THE ROLLS-ROYCE EAGLE.

The Eagle is a twenty-four cylinder horizontal "H" liquid-cooled sleeve-valve engine which has undergone preliminary flight trials in a new Westland high-performance aircraft. The Eagle has a nominal output of 3,500 h.p. and is, therefore, the most powerful piston engine flying in Great Britain.

The general arrangement of the engine, concerning which very little information is permitted for publication, may be seen in the photographs on the next page. It is fitted with a two-speed two-stage supercharger and a contra-rotating airscrew reduction gear, both features which have been successfully incorporated in the Merlin and Griffon engines. After-coolers are located between the supercharger outlets and the induction manifolds of each cylinder block for cooling the charge after compression by the supercharger. The shunt cooling system has been adopted, with integral header tank located at the forward end of the crankcase. In common with the later Merlin and Griffon engines, the Eagle has fuel-injection discharging into the air stream at the supercharger eye.

Dual ignition is provided by the two BTH waterproofed magnetos mounted on either side of the reduction gear casing. The housing of the reduction gearing for the Rotol eight-blade contra-rotating airscrews has been specially arranged to provide minimum power-plant drag.

***ROLLS-ROYCE**—continued.*



The 3,500 h.p. Rolls-Royce Eagle twenty-four cylinder H-type sleeve-valve engine.

THE ROLLS-ROYCE GRIFFON.

At the outbreak of hostilities in September, 1939, a decision was made to go ahead intensively with the production of a similar type of engine to the Merlin but of larger capacity. The Griffon, as this new type came to be called, furthers the original Rolls-Royce policy of fostering the twelve-cylinder 60 degree upright-vee type liquid-cooled power-plant. As a matter of interest it may be stated that the cylinder arrangement and dimensions of the engine are the same as those of the Rolls-Royce "R" engine which was developed for and won the 1929 and 1931 Schneider Trophy contests.

An essential requirement in the design and production of the Griffon was its availability for installation in existing Merlin-powered fighters to ensure an unbroken curve in the improvement of fighter performances. All the experience gained in the Royal Air Force and Fleet Air Arm with the Merlin was used to the full in the design and development of the Griffon.

The Griffon incorporates a number of interesting design features including the provision of a remote gearbox, shaft-driven from the engine, on which are mounted the mechanically-driven accessories required to operate such airframe features as the retractable landing-gear, wheel-brakes, wing flaps, blind-flying instrument panel and the generator for the radio installation.

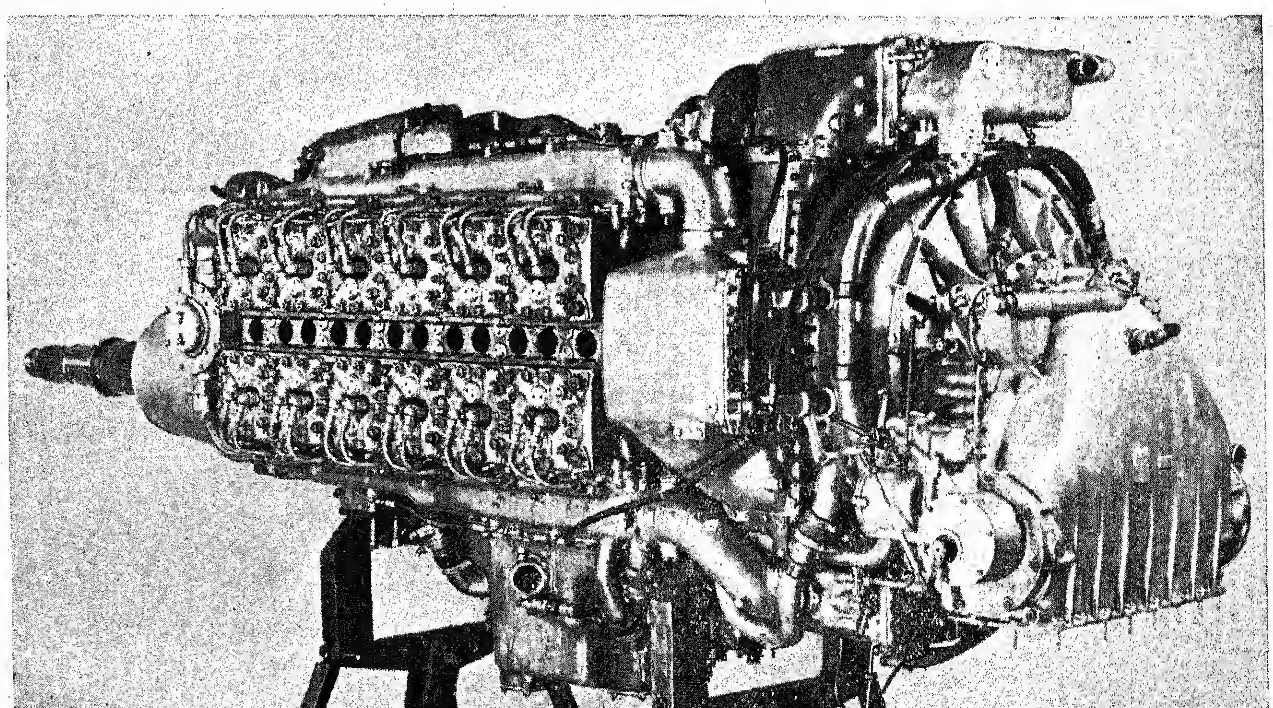
The lower marks of Griffon engine are fitted with two-speed single-stage superchargers. The Griffon II, III and IV all have a maximum rating of 1,735 h.p. at 1,000 ft. (305 m.) and 1,495 h.p. at 14,500 ft. (4,420 m.) and a take-off power of 1,720 h.p. The Griffon II and III have a reduction gear ratio of .451 : 1 and the Griffon IV a ratio of .510 : 1. The Griffon II was fitted in the earlier Firefly I and II until replaced by the Griffon XII. The Griffon III and IV were both fitted in the Spitfire XII.

The Griffon VI is similar to the IV but has increased take-off and maximum boost pressure 15 lbs./sq. in. (1.05 kg./sq. c/m.). This engine has a maximum rating of 1,850 h.p. at 2,000 ft. (610 m.) and 1,635 h.p. at 10,500 ft. (3,200 m.), with 1,815 h.p. available for take-off. This engine is installed in the Seafire XV and XVII.

The Griffon XII is similar to the VI but with lower supercharger gear ratios and a reduction gear ratio of .451 : 1. It has a maximum rating of 1,765 h.p. at sea level and 1,645 h.p. at 11,500 ft. (3,505 m.).

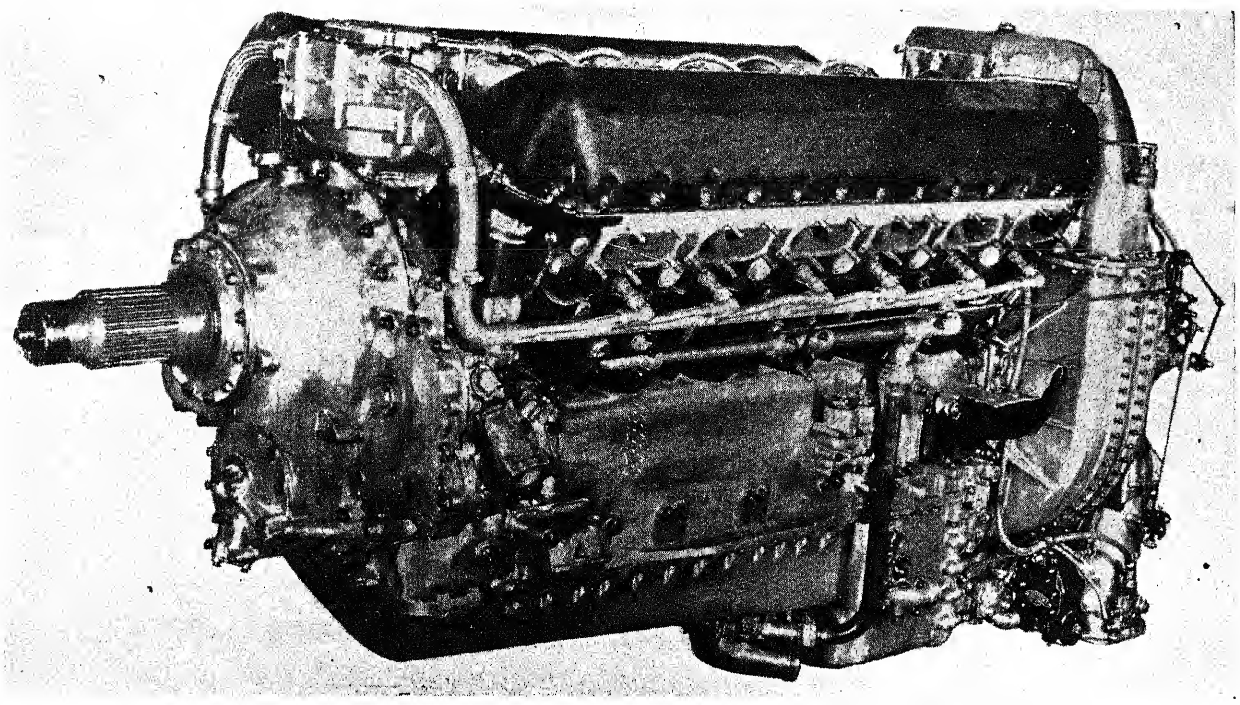
The Griffon 61 is fitted with a two-speed two-stage supercharger and intercooler similar to that installed in the Merlin 61 Series, and compared with the earlier Griffon models it has a considerably improved altitude performance. Its maximum rating is 2,035 h.p. at 7,000 ft. (2,135 m.) and 1,820 h.p. at 21,000 ft. (6,400 m.), with 1,540 h.p. available for take-off. The dry weight of the Griffon 65 is 2,090 lbs. (948 kg.), as compared with 1,800 lbs. (816 kg.) for the single-stage supercharged models previously mentioned. It is installed in the Spitfire 21.

The Griffon 65 is similar to the 61 but is fitted with a reduction gear ratio of .510 : 1 instead of .451 : 1. The Griffon 65 forms



Another view of the 3,500 h.p. Rolls-Royce Eagle sleeve-valve engine.

***ROLLS-ROYCE**—continued.*



The 2,000 h.p. Rolls-Royce Griffon 65 engine with two-speed two-stage supercharger.

the power plant of the Spitfire XIV. The Griffon 66 is the same as the 65 but is fitted with cabin supercharger for high-altitude operation in the Spitfire P.R. XIX.

The Griffon 64 and the Griffon 67 were developed from the 61 and 64 respectively to give increased maximum ratings of 2,375 h.p. at 1,250 ft. (380 m.) and 2,145 h.p. at 15,500 ft. (4,725 m.). The Griffon 64 is installed in the Spitfire 21 and Seafire 46, and the Griffon 67 in the Spitfire XIV.

The Griffon 72 and 74 are modifications of the 65 to meet the requirements of the Royal Navy. Utilising the advantages offered by 150 grade fuel, a maximum boost of 25 lbs./sq. in. (1.76 kg./sq. c/m.) in F.S. gear was stipulated. At this pressure the h.p. recorded at 9,250 ft. (2,820 m.) is 2,245. At sea level with 18½ lbs./sq. in. (1.3 kg./sq. c/m.) boost a take-off power of 2,050 h.p. is available. The main difference between the 72 and 74 is the fitting of a Rolls-Royce Bendix-Stromberg carburettor to the former and a Rolls-Royce injection pump to the latter. The Griffon 72 was fitted in the prototype of the Firefly IV and the 74 is being installed in the production version of that aeroplane.

The Griffon 85 is of the same basic design as the 65 except that it is fitted to drive contra-rotating airscrews and is installed in the Spitfire XIV, 21 and Seafire 45. At a maximum boost of 25 lbs./sq. in. (1.76 kg./sq. c/m.) the Griffon 87, developed from the 85, has a power rating of 2,375 h.p. at 1,250 ft. (380 m.) and 2,145 h.p. at 15,500 ft. (4,257 m.). The Griffon 88 differs from the 87 only in the fitting of an R.R. injection-pump. These contra-rotating Griffon engines are installed in the Spitfire XIV, 21 and Seafire 45 and 47.

A further engine designed to meet the requirements of the Royal Navy is the Griffon 37, which is installed in the Barracuda V. This engine is basically of the Griffon 65 type but with a modified high-output two-speed single-stage supercharger maintaining 18 lbs./sq. in. (1,265 kg./sq. c/m.) boost in either gear ratio. At the maximum boost the power available is 2,055 h.p. at 2,250 ft. (685 m.) and 1,870 h.p. at 10,750 ft. (3,275 m.), and at sea level full throttle gives 2,020 h.p. for take-off.

The Griffon 101 series incorporates a three-speed supercharger and R.R. fuel-injection system. The Griffon 101 and upwards have a reduction gear for single airscrew, and Mk. 121 and upwards have a gear for contra-rotating airscrews. A typical engine in this series, the Griffon 130, maintains over 2,000 h.p. up to 20,000 ft. (6,095 m.). The increased capacity of the new supercharger and third speed drive have been introduced without any increase in dimensions and the weight has only been increased by some 40 lbs. (18 kg.). The complete engine weighs 2,100 lbs. (954 kg.) and has a maximum output of 2,420 h.p. at 5,000 ft. (1,525 m.).

The description below refers specifically to the Griffon 65 but is representative of all marks in the Griffon range fitted with the Rolls-Royce two-speed two-stage supercharger.

TYPE.—Twelve-cylinder 60° Vee liquid-cooled.

CYLINDERS.—Bore 6.0 in. (152.4 m/m.), Stroke 6.6 in. (167.64 m/m.), Swept volume 2,240 cub. in. (36.7 litres). Two blocks of six cylinders are mounted at 60 degrees to each other on inclined upper faces of a two-piece crankcase. Each block comprises a light alloy skirt with a separate light alloy cylinder-head. Separate cylinder liners in high carbon steel, having flanges at their upper ends, are fitted in the light alloy skirts, the flanges of the liners being sandwiched between the head and skirt making the liner practically unstressed in the static condition, thereby reducing distortion. A further advantage of this arrangement is the elimination of internal coolant leaks. Gas tightness is ensured by the use of soft aluminium-alloy jointing rings. A coolant seal on each liner at the base of the skirt is made by rubber collars located between external ribs on the liner. The cylinder assemblies are each retained to the crankcase by fourteen long studs in chrome-vanadium steel which pass through tubes in the cylinder skirt and head, those tubes being sealed against coolant leaks by rubber rings. A further series of small studs form a secondary tie between head and skirt. The heads carry renewable valve seatings in Silchrome. Inlet and exhaust valve guides are made in cast iron and phosphor bronze respectively.

PISTONS.—Machined from close forgings of R.R.59 alloy. The piston carries two compression rings and a drilled scraper ring above the gudgeon-pin and another drilled scraper ring below it. Both scraper rings and scraper ring grooves are drilled to return oil to the crankcase. A fully-floating gudgeon-pin in hardened nickel steel is located by spring wire circlips.

CONNECTING RODS.—Nickel steel forgings machined all over and having H-section shanks. Each assembly consists of a plain rod and a forked rod, the latter carrying a nickel steel bearing block, the halves of which are secured together and to the forked rod by four bolts. This bearing block retains a split flanged thin steel shell lined with lead-bronze which runs directly on the crankpin. Similar split bearing shells are fitted to the plain rod and work on the outer surface of the forked rod block. The small end of each connecting-rod houses a fully-floating bronze bush.

CRANKSHAFT.—Clockwise rotation viewed from rear. One-piece balanced, six-throw machined forging of nitrogen-hardened chrome-molybdenum steel. Crankpins and journals are bored and fitted with oil retaining caps and the webs are drilled to allow oil to be fed axially from each end of the crankshaft to the main journal and connecting-rod bearings. Drive to the reduction gear pinion is from a serrated flange bolted to the front end of the crankshaft. The rear end of the crankshaft is connected by a flexible torsion shaft to the supercharger driving gear and also provides drives to the auxiliary gearbox, oil pumps, coolant pumps, fuel pump, tachometer and constant-speed unit. Angular movement of this flexible torsion shaft is limited by stops attached to the crankshaft.

CRANKCASE.—In two halves. Both castings of aluminium-alloy. Upper portion carries cylinders and crankshaft main bearings. The front of the crankcase forms integrally the rear housing of the airscrew reduction gear and also contains the camshaft and starter motor drives. The lower portion forms the engine sump and contains the oil pump assembly consisting of the main pressure pump, supercharger change-speed operating pump and two scavenge pumps; and also the main coolant pump which is driven through the same train of gears as the oil pumps. The main bearings, of which there are seven, consist of split steel shells lined with lead-bronze alloy, which fit into semi-circular recesses machined in the top half crankcase, and are held in position by forged light alloy bearing caps and nickel-steel studs. In addition to these studs sixteen bolts pass transversely through the caps and the whole width of the crankcase, to give great rigidity but at the same time allowing withdrawal of the lower half crankcase without disturbing the crankshaft.

WHEELCASE.—Aluminium-alloy casting secured by studs at rear end of crankcase. Supercharger unit is in turn bolted on to the back of the wheelcase. The wheelcase houses the two-speed supercharger drive, drives to auxiliary gearbox coupling, engine speed indicator, airscrew constant-speed unit, intercooler pump and fuel pump, and

ROLLS-ROYCE—continued.

also provides a drive to the oil and coolant pumps situated in the lower half crankcase.

Valve Gear.—There are two inlet and two exhaust valves per cylinder. Inlet and exhaust valves are prepared from forgings of K.E.965 steel, a protective layer of Brightray covering the whole of the combustion face and seat of the exhaust valve and the seat only of the inlet valve. Sodium-cooled exhaust valves. Two concentric coil springs control each valve via a steel top washer having a central taper bore containing split bronze collets which locate in a recess in the valve stem. A single central camshaft mounted in seven pedestal brackets fixed to the top of each cylinder head operates both inlet and exhaust valves through rocker arms fitted with spherical-headed adjustable tappet screws. The camshafts which are similar for both cylinder blocks are driven via spur gears, bevel gears and inclined shafts from the reduction gear wheel.

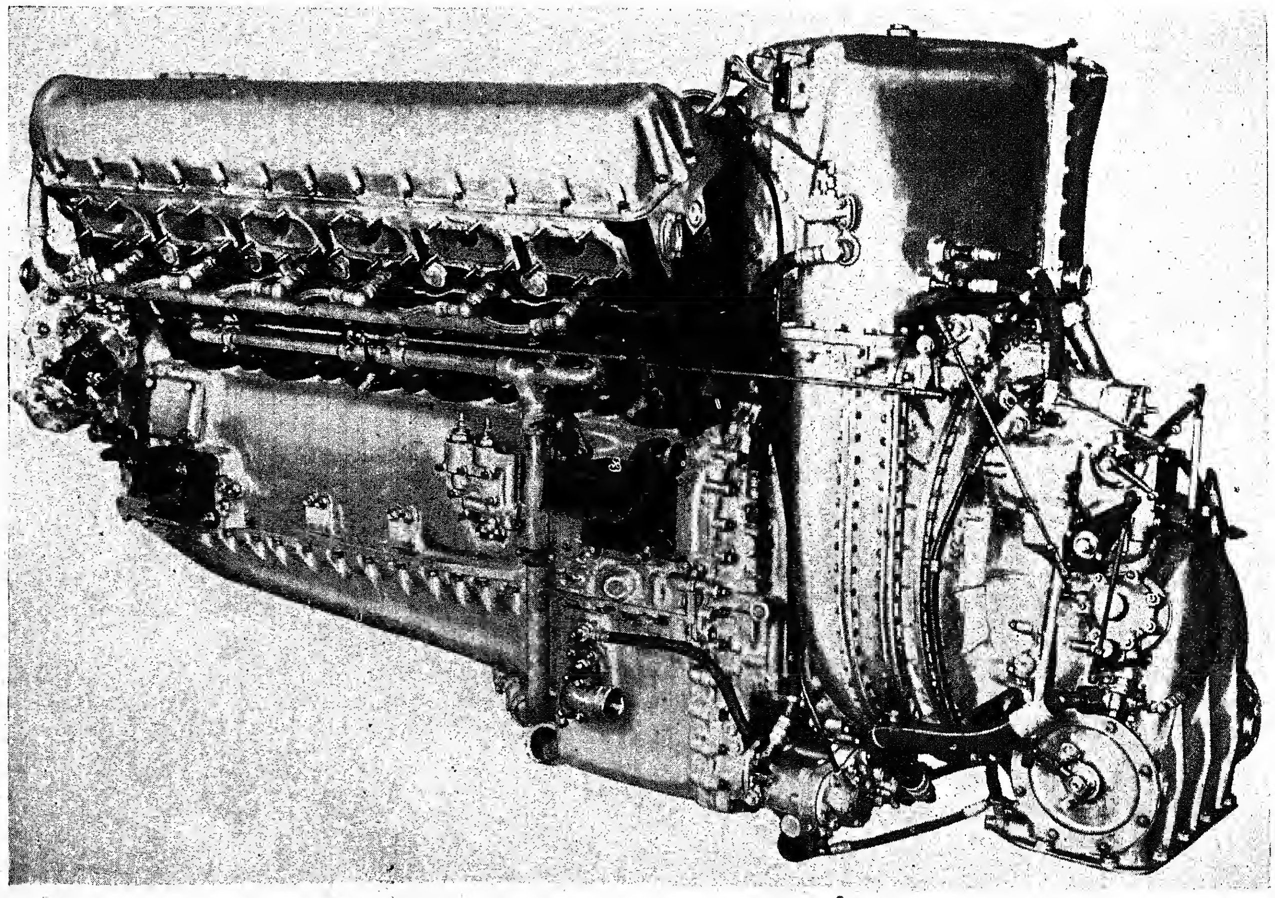
Induction.—On later marks of Griffon, the R.R. injection-pump replaces the standard fuel-pump and conventional carburettor design and combines the feed-pump and metering device in one unit. The desired fuel/air ratio being obtained by using the known relation between air flow and four variables governing it, namely, engine r.p.m., boost-pressure, exhaust back-pressure and boost-temperature. the feed-pump supplies fuel from the tank to the metering section at a constant pressure controlled by a relief-valve, which allows excess fuel to pass back to the inlet side of the pump. The metering is effected by two jets in parallel, whose free areas are controlled by taper needles, one needle being operated by a capsule subject to boost-pressure and atmospheric pressure (exhaust back-pressure) and the other by a temperature sensitive device in the induction pipe. The pressure difference across the jets is controlled by engine speed by means of a flexible diaphragm connected to a needle valve and loaded by a centrifugal governor driven by the engine on the same shaft as the feed-pump. The needle valve admits fuel from the feed pump to one side of the diaphragm which controls the flow through the needle valve so that the pressure difference across the diaphragm always balances the thrust of the centrifugal governor and the jets are arranged to allow fuel to flow from one side of the diaphragm to the other and thus the pressure difference across the jets is the same as that across the diaphragm. By this arrangement the fuel flow through the jet is directly proportional to the r.p.m. The fuel passes through the two jets in parallel which are in the same plane as the diaphragm into the "metered-fuel" chamber and thence across the outer surface of the diaphragm to the delivery pipe to the nozzle in the eye of the rear supercharger casing. The balance of the opposing forces of the pressure difference across the diaphragm and the thrust of the governor is maintained by the opening or closing of the valve which admits more or less fuel as required. The pressure in the governor chamber is higher than that in the governed fuel-chamber and the resultant closing tendency of the valve is opposed by a biasing spring acting on the outer surface of the diaphragm. The spring load is adjusted and provides the means of varying the fuel flow at idling conditions when the thrust from the governor is very small and does not govern. The load from the governor weights become the controlling factor at engine speeds of 1200 r.p.m. and upwards.

Supercharger.—Two-speed two-stage supercharger of the centrifugal type, the change-speed mechanism of which is operated by an automatic change-over mechanism incorporating an electric-pneumatic-hydraulic system operated by an atmospherically-controlled aneroid. The hydraulic oil pressure for operating the centrifugally-loaded clutches of the two-speed mechanism is supplied by the special high-pressure pump previously mentioned. Design of the clutches is such that slip is permitted under acceleration conditions to avoid overloading of gearing and also to damp out, in conjunction with the spring-drive, torsional oscillation from the crankshaft. The delivery pressure of the supercharger is controlled by an automatic servo mechanism coupled through a differential linkage to the throttle so that a constant boost-pressure is maintained at altitude up to full throttle conditions for a fixed position of the pilot's lever.

Ignition.—Ignition is by two twelve-cylinder magnetos combined together in one unit and mounted in the Vee directly behind the reduction-gear housing. Driven by bevel gears and an inclined shaft from the port camshaft drive. Incorporates two separate circuits which are electrically independent of each other. The timing of the two magneto circuits relative to each other is fixed, but an advance and retard range is obtained by differential action in the inclined drive-shaft to the magneto. This differential action is controlled by an automatic servo mechanism coupled to the throttle lever by suitable linkage. Four metal conduits coupled with metal braiding to the magneto housing carry the ignition leads to the sparking plugs via short metal braid connections, this making the system fully screened.

Lubrication.—Dry-sump system. One pressure and two scavenge pumps of the gear-type driven from the wheelcase. The pressure pump delivers oil from the aircraft tank to two relief valves in one unit which controls oil pressure to a high and low pressure system. Any excess oil is spilled back directly into the crankcase. The high pressure system feeds the crankshaft journal bearings, connecting-rod bearings and constant-speed unit. The oil to the constant-speed unit is further increased in pressure by the unit for operation of the variable-pitch airscrew. High pressure oil is also taken from the delivery side of the main pressure pump through a precision gear-type pump of low capacity, where its pressure is further increased for the purpose of operating the change-speed mechanism of the two-speed supercharger drive. The low pressure system is used for feeding oil to the camshaft and rocker mechanism, oil jets feeding the airscrew reduction gears, supercharger drive gears, and various other bearings throughout the engine. Used oil drains back to the lower half crankcase, where it passes through filters to two scavenge pumps, one servicing each end of the lower half, and thence back to the aircraft tank via the oil radiator. The flow of cooling air is controlled automatically by flaps through the medium of a temperature-sensitive device.

Coolant System.—The coolant employed is a mixture of 70% water and 30% ethylene glycol. The coolant is circulated by a centrifugal-type pump to the cylinder blocks and from the cylinder blocks to a small-capacity header tank and from the header tank via a radiator to the coolant-pump inlet. The flow of coolant air through the radiator is controlled, whether manually or automatically, through the medium of a temperature-sensitive device.



The 2,420 h.p. Rolls-Royce Griffon 130 engine with three-speed supercharger.

***ROLLS-ROYCE**—continued.*

ROLLS-ROYCE GRIFFON ENGINES.

Bore × Stroke: 6 in. × 6.6 in. (152.5 m/m. × 167.6 m/m.). Capacity: 2,240 cu. in. (36.7 litres).

Engine	Take-off Power	International Rating	Maximum Power	Dry Weight (plus 2½% tolerance)	Airscrew Gear Ratio	Compression Ratio	Remarks
Griffon 37	1,960 h.p. at 2,750 r.p.m.	1,680 h.p. at 2,600 r.p.m. at 6,500 ft. (1,900 m.) and 1,575 h.p. at 2,600 r.p.m. at 13,750 ft. (4,200 m.)	1,990 h.p. at 2,750 r.p.m. at 2,250 ft. (685 m.) and 1,820 h.p. at 2,750 r.p.m. at 10,750 ft. (3,275 m.)	1,930 lbs. (876 kg.)	.510 : 1	6.00 : 1	Fuel-injection pump. Installed in Barracuda V.
Griffon 61	1,540 h.p. at 2,750 r.p.m.	1,490 h.p. at 2,600 r.p.m. at 13,500 ft. (4,120 m.) and 1,365 h.p. at 2,600 r.p.m. at 26,500 ft. (8,090 m.)	2,035 h.p. at 2,750 r.p.m. at 7,000 ft. (2,135 m.) and 1,820 h.p. at 2,750 r.p.m. at 21,000 ft. (6,400 m.)	2,090 lbs. (948 kg.)	.451 : 1	6.00 : 1	Bendix carburettor. Installed in Spitfire 21, 22 and 24, Seafire 45.
Griffon 64	1,540 h.p. at 2,750 r.p.m.	1,490 h.p. at 2,600 r.p.m. at 13,500 ft. (4,120 m.) and 1,365 h.p. at 2,600 r.p.m. at 26,500 ft. (8,090 m.)	2,375 h.p. at 2,750 r.p.m. at 1,250 ft. (380 m.) and 2,145 h.p. at 2,750 r.p.m. at 15,500 ft. (4,725 m.)	2,090 lbs. (948 kg.)	.451 : 1	6.00 : 1	As Griffon 61 but with increased ratings. Installed in Spitfire 21, 22 and 24 and Seafire 46.
Griffon 65	1,540 h.p. at 2,750 r.p.m.	1,490 h.p. at 2,600 r.p.m. at 13,500 ft. (4,120 m.) and 1,365 h.p. at 2,600 r.p.m. at 26,500 ft. (8,090 m.)	2,035 h.p. at 2,750 r.p.m. at 7,000 ft. (2,135 m.) and 1,820 h.p. at 2,750 r.p.m. at 21,000 ft. (6,400 m.)	2,090 lbs. (948 kg.)	.510 : 1	6.00 : 1	Installed in Spitfire XIV and XVIII.
Griffon 66	1,540 h.p. at 2,750 r.p.m.	1,490 h.p. at 2,600 r.p.m. at 13,500 ft. (4,120 m.) and 1,365 h.p. at 2,600 r.p.m. at 26,500 ft. (8,090 m.)	2,035 h.p. at 2,750 r.p.m. at 7,000 ft. (2,135 m.) and 1,820 h.p. at 2,750 r.p.m. at 21,000 ft. (6,400 m.)	2,090 lbs. (948 kg.)	.510 : 1	6.00 : 1	As Griffon 65 but with cabin supercharger. Installed in Spitfire P.R. XIX.
Griffon 67	1,540 h.p. at 2,750 r.p.m.	1,490 h.p. at 2,600 r.p.m. at 13,500 ft. (4,120 m.) and 1,365 h.p. at 2,600 r.p.m. at 26,500 ft. (8,090 m.)	2,375 h.p. at 2,750 r.p.m. at 1,250 ft. (380 m.) and 2,145 h.p. at 2,750 r.p.m. at 15,500 ft. (4,725 m.)	2,090 lbs. (940 kg.)	.510 : 1	6.00 : 1	As Griffon 65 but with increased ratings. Installed in Spitfire XIV.
Griffon 74	2,004 h.p. at 2,750 r.p.m.	1,510 h.p. at 2,600 r.p.m. at 7,500 ft. (2,280 m.) and 1,405 h.p. at 2,600 r.p.m. at 20,500 ft. (6,250 m.)	2,045 h.p. at 2,750 r.p.m. at sea level and 2,245 h.p. at 2,750 r.p.m, at 9,250 ft. (2,820 m.)	2,100 lbs. (953 kg.)	.510 : 1	6.00 : 1	Installed in Firefly IV.
Griffon 85	1,915 h.p. at 2,750 r.p.m.	1,490 h.p. at 2,600 r.p.m. at 13,500 ft. (4,120 m.) and 1,365 h.p. at 2,600 r.p.m. at 26,500 ft. (8,090 m.)	2,045 h.p. at 2,750 r.p.m. at 7,000 ft. (2,135 m.) and 1,820 h.p. at 2,750 r.p.m. at 21,000 ft. (6,400 m.)	2,140 lbs. (970 kg.)	.4423 : 1	6.00 : 1	Contra-rotating airscrews. Installed in Seafire 45 and 47, Spitfire XIV and 21.
Griffon 87	1,915 h.p. at 2,750 r.p.m.	1,490 h.p. at 2,600 r.p.m. at 13,500 ft. (4,120 m.) and 1,365 h.p. at 2,600 r.p.m. at 26,500 ft. (8,090 m.)	2,350 h.p. at 2,750 r.p.m. at 1,250 ft. (380 m.) and 2,120 h.p. at 2,750 r.p.m. at 15,500 ft. (4,725 m.)	2,140 lbs. (970 kg.)	.4423 : 1	6.00 : 1	As Griffon 85 but with increased ratings. Installed in Seafire 46 and 47, Spitfire XIV and 21.
Griffon 88	1,935 h.p. at 2,750 r.p.m.	1,490 h.p. at 2,600 r.p.m. at 13,500 ft. (4,120 m.) and 1,365 h.p. at 2,600 r.p.m. at 26,500 ft. (8,090 m.)	2,350 h.p. at 2,750 r.p.m. at 1,250 ft. (380 m.) and 2,210 h.p. at 2,750 r.p.m. at 15,500 ft. (2,745 m.)	2,210 lbs. (1,003 kg.)	.4423 : 1	6.00 : 1	As Griffon 87 but with injection pump. Installed in Spitfire XIV and 21.

ROLLS-ROYCE—*continued.*

The header tank, which incorporates features to ensure the efficient separation of steam and coolant, is provided with a loaded relief valve which seals the whole coolant system up to a predetermined pressure. This pressurising of the system raises the boiling point of the coolant, and permits the use of smaller radiators. The header tank relief valve maintains the pressure in the system and also incorporates a suction-operated valve which admits air, if for any reason the pressure falls below atmospheric.

INTERCOOLER SYSTEM.—The coolant employed is a mixture of 70% water and 30% ethylene glycol which is circulated by means of a centrifugal pump from a header tank through a radiator to the jacket situated between the two stages of the supercharger and to the intercooler matrix, placed between the supercharger and induction pipe, and thence back to the header tank. This system which is entirely independent of the main engine system is pressurised and incorporates a similar design of header tank, relief valve and radiator-cooling air control as on the main system, but no thermostat. Heat exchange from the coolant is carried out by an independent radiator in the aircraft system in the normal manner.

STARTING.—The starting system is of the combustion type. Five cartridges are contained in a breech, which is indexed mechanically from the cockpit of the aircraft and fired electrically. This is piped to the starter-unit bolted to the rear face of a housing integral with the reduction-gear casing on the starboard side of the engine. The starter-unit drives through dogs and a train of gears on to the gearwheel of the airscrew-shaft. Fuel priming-nozzles are provided in the induction system to ensure easy starting.

AUXILIARIES.—All the aircraft service accessories are mounted on a separate gearbox on the bulkhead and driven by a shaft through universal joints from the top of the wheelcase. This gearbox has its own independent lubrication system and supply.

AIRSCREW DRIVE.—Left-hand tractor. The airscrew shaft is driven through a single spur reduction gear housed partly in a casing formed integrally with the crankcase and for the remainder, in a casing bolted to the front end of the crankcase. The hollow driving pinion mounted in two roller bearings is concentric with, and is driven by, a hollow coupling shaft serrated at both ends. One end engages with a serrated driving ring on the crankshaft and the forward end with the internal serrations on the driving pinion. This coupling shaft insulates the reduction gear unit from crankshaft loadings and torsional vibrations. The hollow airscrew shaft has an integral flange which is bolted to the ring gear driven by the pinion, and is mounted in roller-bearings, axial thrust being taken in either direction by a ball thrust-bearing. A hydraulically-operated variable-pitch airscrew is centralised upon cones at each end when fitted to the airscrew shaft. High pressure oil from the constant-speed unit is supplied to the rear half of the reduction-gear casing from whence it is transferred to two concentric oil tubes, secured within, and rotating with the airscrew shaft and so to the pitch-operating mechanism of the airscrew. For the purpose of valve and ignition timing the pinion has timing marks incorporated on a bevelled face at the front end and a pointer is fitted on the pinion cover and viewed by removal of an inspection cover.

PERFORMANCE.—See Table.

THE ROLLS-ROYCE MERLIN.

The Merlin 61 Series engines compared with their predecessors, the single-stage two-speed Merlins, have a very considerably improved performance both with regard to maximum power available and the altitude to which it is maintained. The mechanical specification is basically similar to the Merlin XX described in previous issues of this Annual, with the exception of an entirely new two-speed two-stage supercharging system.

The two-speed two-stage supercharger has two rotors driven on a common shaft and is really two separate superchargers in series. The mixture of air and petrol which is drawn through the carburettor is compressed by the first stage supercharger and is then delivered to the inlet of the second stage supercharger where it is still further compressed and is finally delivered to the main induction pipe feeding the twelve cylinders.

The process of compressing, by the superchargers, the large quantity of air required to burn the fuel results in considerable heating of the mixture and in order to reduce the mixture temperature to a normal figure, recourse is made to charge cooling, or intercooling as it is called.

The intercooler system is entirely separate from the main cooling system and one of the greatest advantages of this installation is that the actual radiator from which the excess charge temperature is dissipated to the atmosphere may be placed at any convenient position on the power-plant or aeroplane.

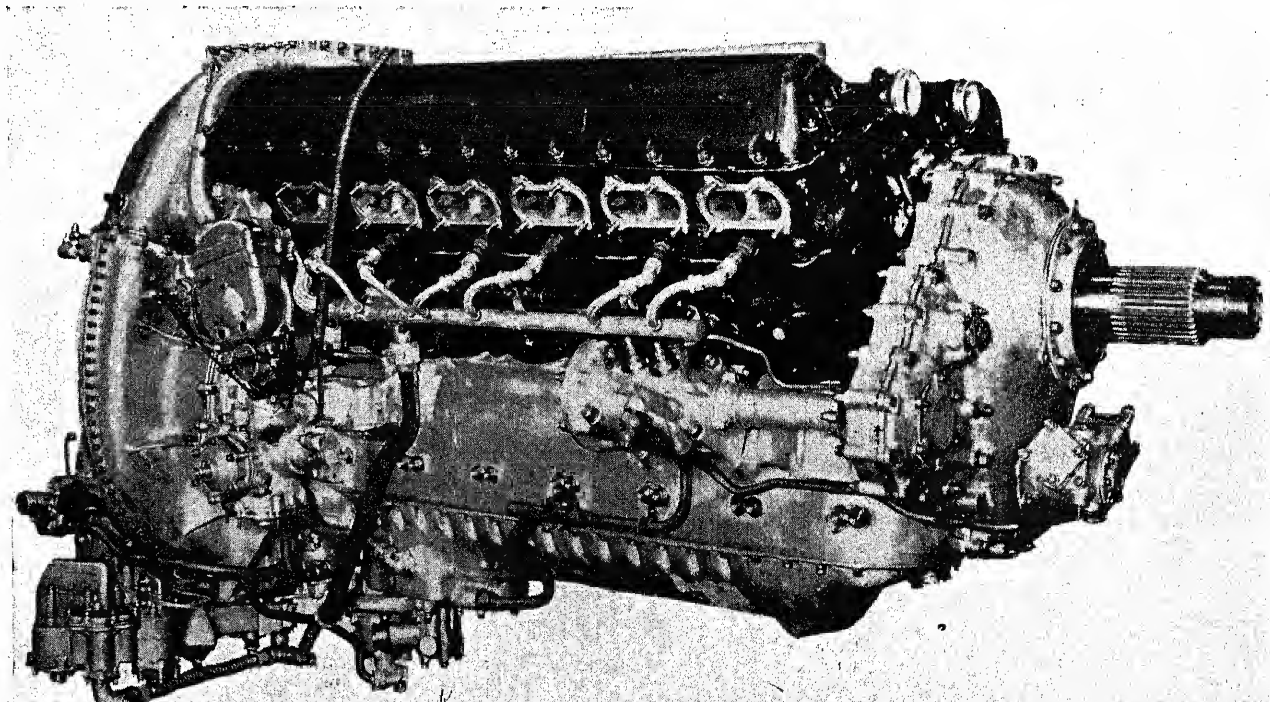
The Merlin 620 Series incorporates detail improvements, such as end-to-end crankshaft lubrication whereby oil is fed to each end of the hollow crankshaft and thence from the crankshaft to the main and big end bearings. A general improvement in respect of control loading has been effected and fixed ignition is used which eliminates control rods and reduces the loadings by some 22½ lbs. All the main structural joints have wider flanges, and changes have been introduced in the cylinder liners to ensure the maximum service and reliability under civil operation.

The Merlin 620 has been specifically designed to suit North Atlantic operation. It incorporates an after-heater to maintain the charge temperature when flying at near-Arctic conditions. On proving flights and during the war period it was found that if the mixture temperature dropped below 40°C. the lead content of the fuel separated out and formed a deposit on the sparking plugs; the purpose of the after heater is to prevent this contingency. Many other features have been built into this series of civil Merlin engines to ensure maximum service between overhauls. The engines are supplied as complete power-plants ready for attachment to the airframe, this is an important contributing factor in the compactness of the design. All engine-driven aircraft accessories have been removed to an accessory gear-box which is driven from the engine. The gear-box on the Douglas DC-4M is of Rolls-Royce design and manufacture.

The Bendix-Stromberg carburettor has been replaced by a single-point fuel-injection system. This fuel system was first used on the Merlin 130 and 131 military engines which power the D.H. Hornet. These latter engines were specially designed for this installation and incorporate down-draft induction systems to permit a general cleaning up of the engine and so reduce frontal area. This method of induction is not used on any other Merlin engine.

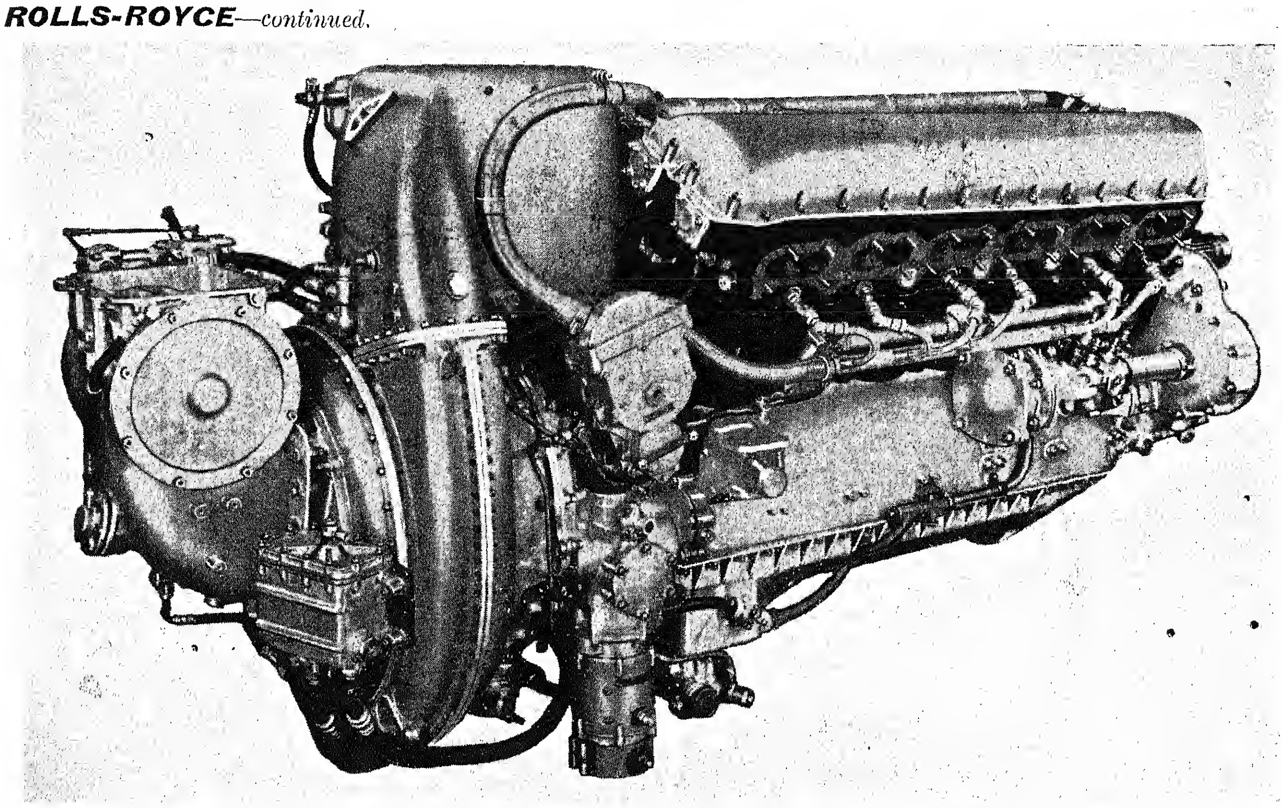
TYPE.—Twelve-cylinder 60° Vee liquid-cooled.

CYLINDERS.—Bore 5.4 in. (137.16 m/m.), Stroke 6 in. (152.4 m/m.), Swept volume 1,647 cub. in. (27 litres). Two two-piece cylinder



The Rolls-Royce Merlin 61 engine with two-speed two-stage supercharger.

ROLLS-ROYCE—*continued.*



The 2,030 h.p. Rolls-Royce Merlin 130 engine with downdraught induction system for installation in the D.H. Hornet.

blocks of cast R.R.50 aluminium-alloy have separate heads and skirts. Six cylinder liners of high carbon steel in each block are directly in touch with cooling liquid. Liner is spigotted directly in skirt at top and by a loose flanged collar at the bottom, the flange of this collar being trapped between skirt and crankcase. Integral flange at top of liner beds direct into cylinder head face to make gas joint. Coolant joint at base of liner made by two rubber rings. Fourteen long studs extend in coolant tight tubes from top of cylinder block into crankcase. Twenty-four additional short studs screwed into the bottom of the cylinder-head clamp the upper liner flanges between the cylinder head and skirt. Renowable Silchrome valve seatings screwed into cylinder heads. Valve guides of cast-iron for inlets and phosphor bronze for exhausts.

Pistons.—Machined from forgings of R.R.59 alloy. Three compression and two scraper rings. One of the latter above and other below gudgeon pin. Both grooves and rings drilled to return oil from walls. Fully-floating hollow gudgeon pins of hardened nickel-chrome steel retained in position by spring circlips.

Connecting Rods.—Nickel steel forgings machined to H-section all over. Each pair consists of plain rod and forked rod, latter carries nickel-steel bearing block, which accommodates the steel backed lead bronze alloy bearings. Halves of block secured together and to forked rod by four bolts. Small-end of each connecting rod houses floating phosphor bronze bush.

Crankshaft.—One-piece six-throw, Machined forging of chrome-molybdenum steel. Integral balance-weights. Nitrogen-hardened. Crankpins and journals bored and fitted with oil-retaining covers. Drive to reduction-gear pinion is through a splined coupling shaft which fits into a splined flange bolted to front end of crankshaft. To damp out irregularities in angular velocity and torque, drive from crankshaft to supercharger and timing gears and auxiliary components is through torsionally flexible shaft which provides spring drive. Twisting of this shaft is limited by hollow sleeve.

Crankcase.—In halvos. Both castings of aluminium-alloy. Upper portion carries cylinders, boarings of crankshaft and part of housing for airscrow reduction goar. Lower portion is sump case and carries the oil pumps and filters. Main bearings, split mild-steel shells lined with lead-bronze alloy, fit into recesses machined in the crankcase. Bearings held in position by caps. Besides usual bearing cap studs, soven pairs of long bolts pass transversely through caps and across whole width of crankcase. Dosign gives rigidity of integrally-cast bearing cap but allows withdrawal of lower portion of crankcase without disturbing bearings.

Wheelcase.—Aluminium casting socured by studs at rear end of crankcase. Supercharger unit goes on to back of wheelcase. Latter houses drives to the camshafts, magnetos, coolant and oil pumps, supercharger, hand and electric starters, and the electric generator.

Valve Gear.—Two inlet and two exhaust valves of K.E. 965 steel parallel with centre line of each cylinder block. Inlet-valves on inside of Vee have stellited ends. Exhaust valves have sodium-cooled stems and Brightray over crown and seating surfaces and stellited ends. Each valve has two concentric coil-springs, kept in place by collar and split wedgo. Spring circlip retains valve in guide should valve-springs fail. Each valve is worked through a separate steel rocker which has a spherical-headed tappet-screw and lock-nut at the valve end for adjustment. Camshaft, along top of each cylinder-block in seven boarings, driven by inclined shaft and bevel gears from wheelcase.

Induction (Merlin 61 Series).—Twin-choke updraught carburettor of Rolls-Royce and S.U. design supplies mixture to supercharger. Two air-passages are coupled to a single Rolls-Royce type of forward-facing air-intake. Each choke is supplied by a separate diffuser nozzle at right-angles to airstream; by slow running device, by dischargo orifice of accelerator-pump; and by main fuel-control jet of submerged type controlled by taper needle. Automatic mixture-control device incorporated in carburettor. One jet controlled by aneroid exposed to atmospheric pressure. In the event of failure of aneroid mixture returns automatically to full rich. Other jet controlled by aneroid subject to boost pressure and safeguarded against damage from back-fires by a disc-valve which closes the communicating vent. Positive methods against freezing; heated coolant circulates through jackets around chokes; warm scavenge oil circulates through hollow throttle-valves. Twin fuel pumps driven by independent quill shafts. If one pump fails, other has more than enough capacity to meet maximum demand. Any fuel in excess is returned through disc-valvo to suction side.

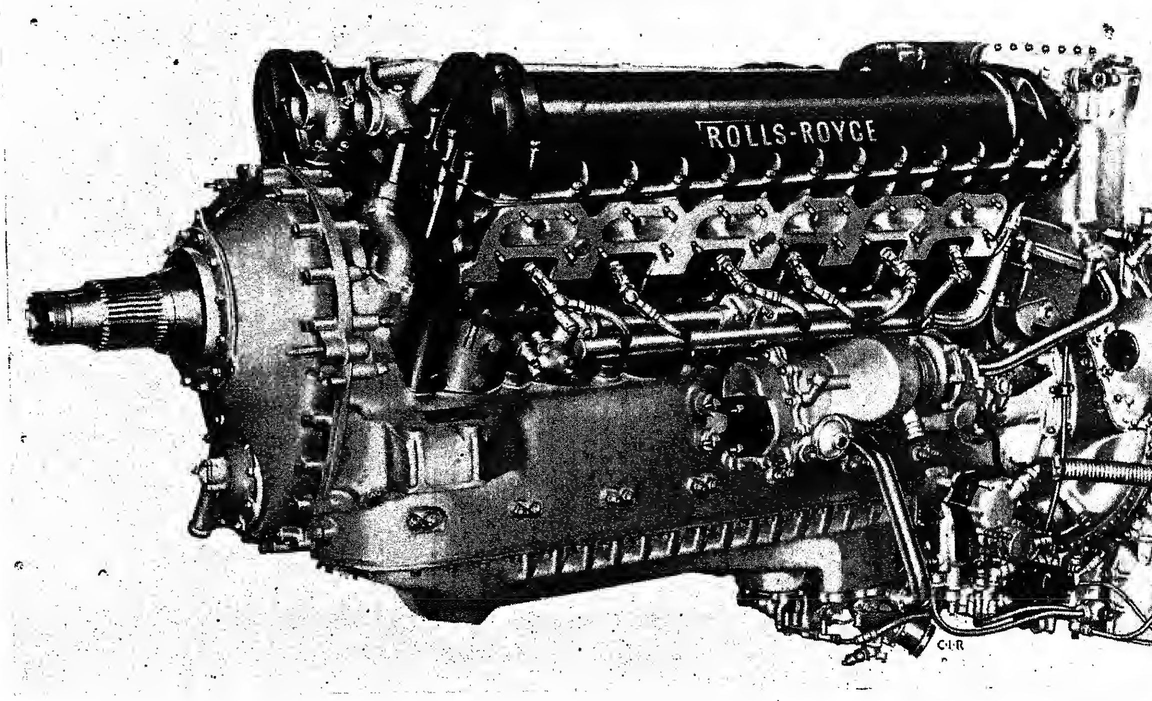
Fuel Injection System (Merlin 130, 131, 620 and 621).—The fuel-injection system comprises a gear-type pump supplying fuel to a five-plunger pump operated by a swash-plate. The stroke and the capacity of the pump are varied by alteration of the angle at which the swash-plate operates. The swash-plate assumes a mean position after compensating for all the variables determining fuel demand. Variation in pump capacity or pump stroke is by a Z-shaft and rocking levers linked to an oil-operated servo-piston which shortens the stroke and a second piston subject to boost pressure which lengthens it, a balance between these two forces being established by a small leak valve. The sensitive portion of the valve is controlled by a capsule subject to boost pressure on the outside charge temperature on the inside, and prevailing atmosphere pressure on the end convolution. As with all positive displacement pumps elimination of air in the system is essential, a de-aerator is interposed between the delivery side of the goar pump and the suction side of the plunger pump. By this means all air is expelled before the fuel enters the plunger pump and accurate metering is assured.

Supercharger.—Two-speed two-stage supercharger, change-speed mechanism of which is operated by oil pressure from scavenge system. Delivery pressure of supercharger is controlled by automatic servo-mechanism coupled through differential linkage to throttle so that opening of latter is controlled to suit boost-pressure.

Ignition.—Two twelve-cylinder magnetos spigot-mounted, one on each side of wheelcase. Each driven by skew-gear from upper vertical drive-shaft through serratod couplings. System fully screened. Three metal conduits coupled with metal braiding to magneto-housings. Short metal-braided connections to sparking plugs. Special heat-resisting adaptors on exhaust side. Resistors aro fitted in the plug adaptors.

Lubrication.—Dry sump system. One pressuro and two scavenge pumps of the goar type driven from wheelcase through idler gear from lower vertical drive-shaft to coolant pump. The pressure pump delivers high pressure oil from the aircraft tank, to the crankshaft and big-end bearings via a relief valve unit. High pressure oil is also delivered to the constant-speed airscrew unit where its pressure is still further increased for operation of the variable-pitch airscrew. Oil at lower pressure is delivered from the relief valve unit to the camshaft and rocker mechanism, to oil jets feeding the airscrew reduction gears, to the supercharger drive mechanism and to various other bearings and goars throughout the engine. Used oil drains back to the lower half crankcase where it passes through filters to two scavenge pumps, one servicing each end of the lower half. The scavenge pumps deliver the used oil via the two-speed supercharger gear change operating gear and the carburettor throttles to an oil cooler and thence back to the aircraft tank. An automatic valve is fitted in the scavenge system which allows the oil to by-pass the cooler when below a predetermined temperature; the function of this valve is to maintain the oil at a constant temperature, and to safeguard the cooler against damage due to the excessive pressures which can be developed when the oil is cold.

***ROLLS-ROYCE**—continued.*



The Rolls-Royce Merlin 620 twelve-cylinder Vee liquid-cooled engine which was designed specifically for North Atlantic operations.

Coolant System.—The coolant employed is a mixture of 70% water and 30% ethylene glycol. It is circulated by means of a centrifugal type pump from a small capacity header tank through radiators to the cylinder blocks and thence back to the header tank. The flow of cooling air through the radiator is controlled, either manually or automatically, through the medium of a temperature sensitive device. The header tank, which incorporates features to ensure the efficient separation of steam and coolant, is provided with a loaded relief valve which seals the whole coolant system up to a predetermined pressure. This pressurising of the system raises the boiling point of the coolant, and permits the use of smaller radiators. The maximum permissible coolant temperature is by this means raised to 135°C. The header tank relief valve maintains the pressure in the system, and also incorporates a suction-operated valve which admits air, if for any reason the pressure falls below atmospheric.

Intercooler System.—The coolant employed is a mixture of 70% water and 30% ethylene glycol which is circulated by means of a centrifugal pump from a header tank through the radiator to the jacket situated between the two stages of the supercharger and to the intercooler matrix, placed between the supercharger and induction pipe, and thence back to the header tank. This system which is entirely independent of the main engine system is pressurized and incorporates similar design of header tank, relief valve and radiator cooling air control as on the main system, but no thermostat. Heat exchange from the coolant is carried out by an independent radiator in the aircraft system in the normal manner.

Starting.—The electrical equipment includes an electric starter and a dynamo capable of keeping the aircraft batteries fully charged, and to balance the current consumption required by the numerous electrically operated devices on the modern service aeroplane. Press-button electric starting is therefore available and is capable of functioning efficiently under extremely low temperature conditions. Auxiliary hand-turning gear with a reduction ratio of 13.56 : 1 operates through a portion of same gear-train as electric starter. Multi-plate clutch, common to both systems, incorporated on the starter lay-shaft, is designed to slip in the event of a backfire.

Accessories.—Provision is made on the engine for driving various auxiliary units needed for aircraft services, such as air compressors for gun-turret operation, hydraulic pumps for retractable undercarriages and bomb doors, etc., engine speed indicator, vacuum pumps and the constant-speed airscrew operating pump. Necessary pipework is fitted on the engine for employment of an automatic fire-extinguishing system and also a de-icing equipment for the airscrew.

Airscrew Drive.—Airscrew shaft driven through single spur reduction gear (.42/1) at the front end of crankcase. Hollow driving pinion in two roller-bearings co-axial with crankshaft from which it is driven by a short shallow shaft serrated at both ends. One end engages with crankshaft flange and forward end with internal serrations on driving pinion. Hollow shaft insulates pinion bearings from the crankshaft loadings. Pinion engages with toothed ring bolted to flange integral with hollow airscrew shaft. This runs on roller-bearings and has ball-bearing which takes axial thrust in either direction. Airscrew shaft takes the Rotal or D.H. Hydromatic constant-speed airscrew. High-pressure oil for operation of hydraulic airscrew supplied through a tube secured within and rotating with the shaft. This tube is fed from spherically-seated oil-connection in the housing of the rear half of the reduction gear casing. Airscrew hub is centralised upon cones at each end.

Performance.—See Table.

ROLLS-ROYCE MERLIN ENGINES.

Bore × Stroke : 5.4 in. × 6 in. (137.3 m/m. × 152.5 m/m.). Capacity : 1,649 cu. in. (27 litres.).

Engine	Take-off Power	Emergency Maximum Power	Maximum Climbing Power	Maximum Cruising Power	Dry Weight	Airscrew Gear Ratio	Remarks
Merlin 140	1,725 h.p. at 3,000 r.p.m.	1,780 h.p. at 3,000 r.p.m. at 4,500 ft. (1,370 m.) and 1,650 h.p. at 3,000 r.p.m. at 16,750 ft. (5,110 m.)	1,410 h.p. at 2,850 r.p.m. at 10,000 ft. (3,050 m.) and 1,315 h.p. at 2,850 r.p.m. at 20,500 ft. (6,250 m.)	1,200 h.p. at 2,650 r.p.m. at 10,250 ft. (3,130 m.) and 1,185 h.p. at 2,850 r.p.m. at 23,750 ft. (7,245 m.)	1,780 lbs. (808 kg.)	.512 : 1 (Contra-rotating)	Two-speed two-stage supercharger. Intercooled. R.R.-S.U. fuel injection pump. R.R. accessory gear-box.
Merlin 500	1,610 h.p. at 3,000 r.p.m.	1,635 h.p. at 3,000 r.p.m. at 2,250 ft. (690 m.) and 1,510 h.p. at 3,000 r.p.m. at 9,250 ft. (2,820 m.)	1,215 h.p. at 2,850 r.p.m. at 9,750 ft. (2,975 m.) and 1,135 h.p. at 2,850 r.p.m. at 16,500 ft. (5,030 m.)	1,080 h.p. at 2,650 r.p.m. at 8,750 ft. (2,670 m.) and 1,015 h.p. at 2,650 r.p.m. at 15,500 ft. (4,730 m.)	1,525 lbs. (692 kg.)	.420 : 1 (R.H. tractor)	Two-speed single-stage supercharger. S.U. anti-"G" float typo carburetter.
Merlin 600, 620 and 621	1,725 h.p. at 3,000 r.p.m.	1,770 h.p. at 3,000 r.p.m at 4.000 ft. (1,220 m.) and 1,655 h.p. at 3,000 r.p.m. at 16,500 ft. (5,030 m.)	1,390 h.p. at 2,850 r.p.m. at 9,500 ft. (2,900 m.) and 1,315 h.p. at 3,000 r.p.m. at 20,500 ft. (6,250 m.)	1,160 h.p. at 2,650 r.p.m. at 10,000 ft. (3,050 m.) and 1,160 h.p. at 2,850 r.p.m. at 23,500 ft. (7,170 m.)	1,700 lbs. (772 kg.) (Merlin 620) 1,740 lbs. (790 kg.) (Merlin 620 and 621)	.4707 : 1 (Merlin 620) .420 : b (Merlin 600 and 621)	Two-speed two-stage supercharger. Intercooled. Charge heater. R.R. S.U. fuel injection pump. R.R. accessory gear-box. Electric starter.

CZECHOSLOVAKIA

The new organisation of the Nationalised Czechoslovak Aircraft Industry is described in the Aeroplane Section of this book. The production of aero-engines in concentrated exclusively in the following factories :—

AUTOMOBILOVE ZAVODY, NARODNI PODNIK (Motor Car Works, National Corporation).
Zavod Cakovice (Works Cakovice) (formerly Avia). Produces Avia aero-engines.
Zavod Otrokovice (Works Otrokovice) (formerly Zlin). Produces Persy and Toma engines formerly built by Zlin.
LETECKE ZAVODY, NARODNI PODNIK (Aviation Works, National Corporation).
Zavod Jinonice (Works Jinonice) (formerly Walter). Produces Walter aero-engines.
Zavod Karlin (Works Karlin) (formerly Praga). Produces Praga aero-engines.

All business matters are handled by the following organisation :—
ČS. ZAVODY KOVEDELNE A STROJIRENSKE, NARODNY PODNIK. ODD LETECKY PRODEJ (Czechoslovak Metal-working and Mechanical Engineering Plants, National Corporation. Sales Department of Aviation Products.)
HEAD OFFICE : JINONICE-PRAGUE XVII.
This is the central Sales and Propaganda office of the Nationalised industry. It is established in the offices of the former Walter company.

AVIA.

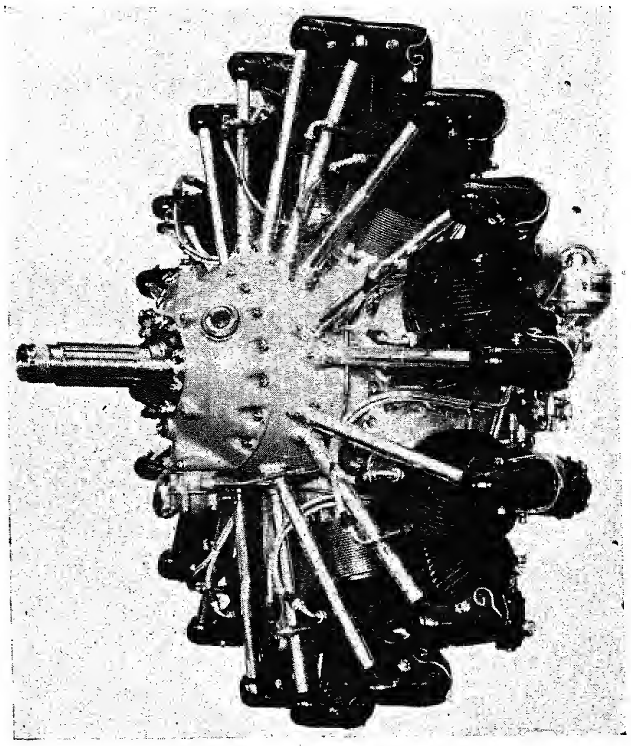
AUTOMOBILOVE ZAVODY, NARODNI PODNIK (Motorcar Works, National Corporation).
Zavod Cakovice (formerly Avia).
HEAD OFFICE AND WORKS : PRAGUE-LETNANY.
Managing Director : Ing. J. Stěnička.
Chief Designer : Ing. V. Kasal.

The original Avia company was formed after the War 1914-18 and was later taken over by the Skoda company. Manufacturing both aircraft and aero-engines, the Avia company was said to have the largest aero-engine factory in Czechoslovakia.

Since the last war the Avia company has been incorporated into the new National Corporation, and aero-engine production has been resumed in the former Avia engine plant at Letnany. Improvements have been made in the RK 17 engine which was in production before the war, and new types of engines are under development.

THE AVIA RK 17.

TYPE.—Nine-cylinder radial air-cooled, supercharged.
CYLINDERS.—Bore 130 m/m. (5.07 in.), Stroke 140 m/m. (5.46 in.). Compression ratio 6.4 : 1. Barrels are steel forgings with nitrided bores. Cylinder heads are aluminium castings.
PISTONS.—Special aluminium-alloy forgings.
CONNECTING RODS.—High-tension steel forgings. Lead-bronze big-end bearings.
CRANKSHAFT.—Nitrided special steel forging.
CRANKCASE.—Two-piece main case an aluminium-alloy casting.
VALVE GEAR.—Two valves per cylinder, exhaust valve sodium-filled. Eight-cam disc. Enclosed push-rods and rocker gear.
CARBURATION.—Single-barrel Stromberg-Zenith NAR 80 carburettor. Alternatively Zenith ZA 2-80 carburettor may be fitted for long flights.
SUPERCHARGER.—Centrifugal type. Gear ratio 10.7 : 1.
IGNITION.—Two Scintilla GN 9D-SCN-F or LV9-D-4 magnetos. Two sparking-plugs per cylinder.
LUBRICATION.—Dry sump pressure lubrication. Two AM fuel pumps.
AIRSCREW DRIVE.—Fixed-pitch wood or metal airscrew. Adaptation for constant-speed airscrew, either with mechanical regulation, type Argus, or with Hamilton Standard constant-speed regulator unit.
FUEL GRADE.—87 Octane.
DIMENSIONS.—Diameter 1.184 m. (40.61 in.), Length 1.065 m. (41.93 in.).
WEIGHT DRY (with normal equipment).—285 kg. (628 lbs.).



The 480 h.p. Avia Rk 17 radial air-cooled engine.

PERFORMANCE.—Rated output 420 h.p. at 2,200 r.p.m. at 8,200 ft. (2,500 m.), Take-off power 480 h.p. at 2,350 r.p.m., Fuel consumption 255 gr. (0.562 lbs.) per h.p./hr., Oil consumption 6.5 gr. (.0143 lbs.) per h.p./hr.

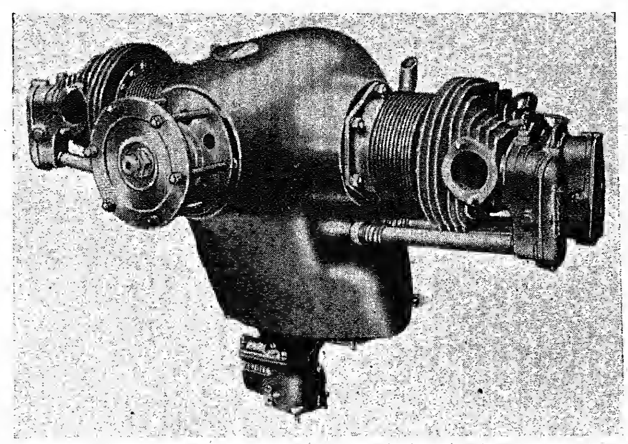
PRAGA.

LETECKÉ ZÁVODY, NÁRODNI PODNIK (Aviation Works, National Corporation).
Zavod Karlin (formerly CKD-Praga).
HEAD OFFICE AND WORKS : LIBEŇ AND MALEŠICE, PRAGUE VIII.
Director : Ing. R. V. Stolle.
Chief Designer : J. Doležal.

The Praga company, originally under the name of Breitfeld-Daněk and Co., Ltd., started to build aero-engines under licence in 1915. Between the Wars the company built a range of engines, both liquid and air-cooled, of from 40 to 1,000 h.p. In addition to extensive production facilities, the works includes large repair and test shops, equipped for handling both reciprocating engines and turbo-jet units.

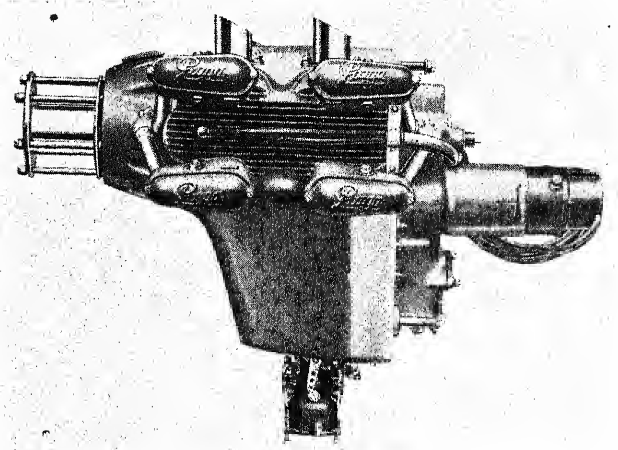
THE PRAGA B2.

TYPE.—Two-cylinder horizontally-opposed air-cooled.
CYLINDERS.—Bore 105 m/m. (4.13 in.), Stroke 110 m/m. (4.33 in.), Total capacity 1,906 cub. c/m. (116.31 cub. in.), Compression ratio 6.7 : 1. Barrels machined from chrome steel forgings. Aluminium-alloy heads. Valve-seats steel, guides heat-treated iron.
PISTONS.—Aluminium-alloy. One scraper and three compression rings.
CRANKCASE.—One-piece aluminium-alloy casting. Three-point mounting.
CRANKSHAFT.—One-piece, forged. One ball thrust bearing and two main roller-bearings. Connecting-rods in patented roller-bearings.
VALVE GEAR.—Two interchangeable valves of stainless steel per cylinder. Two ball-bearings to each rocker-arm lubricated by grease-gun. Oil-tight rocket-boxes.
CARBURATION.—One carburettor attached to the lower part of the crankcase ; suction pipes passing through oil-sump.
IGNITION.—Two magnetos with impulse starter and with manual advance.
LUBRICATION.—Integral with engine, no external connections. Oil-sump holds three litres (0.66 Imp. gallon). Pressure and scavenge pumps with two filters.
AIRSCREW DRIVE.—Direct. Right-hand tractor.
DIMENSIONS.—Width 854 m/m. (33.56 in.), Length 610 m/m. (24.07 in.), Height 515 m/m. (20.24 in.).
WEIGHT DRY (with airscrew hub).—48 kg. (105.8 lbs.).
PERFORMANCE.—Rated power 40 b.h.p. at 2,400 r.p.m., Maximum power 45 b.h.p. at 2,510 r.p.m., Fuel consumption (82 octane) at rated power 230-250 gr./h.p./hr. (0.51-0.55 lbs./h.p./hr.), Fuel consumption at cruising power 225 gr./h.p./hr. (0.50 lbs./b.h.p./hr.), Oil consumption 0.2-0.3 kg./hr. (0.44-0.66 lbs./hr.).



The 45 h.p. Praga B2 two-cylinder engine.

PRAGA—*continued.*



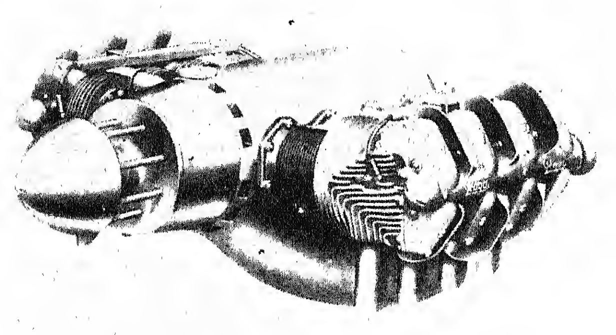
The 60 h.p. Praga D engine.

THE PRAGA D.

TYPE.—Four-cylinder horizontally-opposed air-cooled.
CYLINDERS.—Bore 95 m/m. (3.74 in.), Stroke 100 m/m. (3.93 in.), Total capacity 2,386 cub. c/m. (173 cub. in.), Compression ratio 5.72 : 1. Barrels are chrome-steel forgings. One special aluminium-alloy cast head to each pair of cylinders. Rocker-chambers cast in one piece with head.
PISTONS.—Special aluminium-alloy drop forgings. One scraper and three compression rings.
CONNECTING RODS.—Drop-forged, with divided and hardened big-ends and patented roller-bearings.
CRANKSHAFT.—Four-throw one-piece forging, running on roller-bearings.
CRANKCASE.—Aluminium-alloy casting, with integral oil tank of eight litres (1.72 Imp. gallon) capacity. Three-point mounting.
VALVES AND VALVE GEAR.—Valve-seats of special steel alloy, valve-guides of perlitic iron.
CARBURATION.—Carburettor attached to the lower part of the crankcase with air intake passing through oil sump tank.
IGNITION.—Two magnetos with impulse-starter clutch and manual advance.
LUBRICATION.—Pressure and scavenge oil pumps with oil filters.
ACCESSORIES.—Tachometer drive, fuel pump, hand starter.
AIRSCREW DRIVE.—Direct, right-hand tractor.
DIMENSIONS.—Width 810 m/m. (31.83 in.), Length 746 m/m. (29.32 in.), Height 542 m/m. (21.30 in.).
WEIGHT DRY.—64 kg. (141 lbs.).
PERFORMANCE.—Rated power 60 b.h.p. at 2,480 r.p.m., Maximum power 79 b.h.p. at 2,610 r.p.m., Fuel consumption at rated power 240-245 gr./h.p./hr. (0.53-0.54 lbs./h.p./hr.), Fuel consumption at cruising power 220 gr./h.p./hr. (0.49 lbs./h.p./hr.), Oil consumption 0.4 kg./hr. (0.88 lbs./hr.).

THE PRAGA E.

TYPE.—Eight-cylinder horizontally-opposed air-cooled.
CYLINDERS.—Bore 95 m/m. (3.74 in.), Stroke 100 m/m. (3.93 in.), Total capacity 5,672 cub. c/m. (335.99 cub. in.), Compression ratio 5.8 : 1. Barrels in chrome-steel forging. One special aluminium alloy cast head common to each pair of cylinders.
PISTONS.—Special aluminium-alloy.
VALVES.—Valve-seats from special alloy steel. Valve-guides from perlitic iron.
CRANKSHAFT.—One-piece drop forging from special steel, in roller-bearings. Connecting rods have patented roller-bearings.
CRANKCASE.—Aluminium-alloy casting, integral with oil-sump tank of 13 litres (2.86 Imp. gallons) capacity. Three-point mounting. Outline and shape suitable for installation into fuselage or wing with minimum drag.
CARBURATION.—One carburettor fastened to the rear cover of the crankcase, suction pipes passing through oil tank.
IGNITION.—Two magnetos with impulse-starter clutch and automatic advance.
LUBRICATION.—Pressure and scavenge pump with filters.
ACCESSORIES.—Tachometer drive, generator drive, air pump drive and two fuel pumps.
AIRSCREW DRIVE.—Direct. Right-hand tractor.
DIMENSIONS.—Length 1,225 m/m. (48.14 in.), Width 890 m/m. (34.47 in.), Height 465 m/m. (18.27 in.).
WEIGHT DRY.—120 kg. (26.45 lbs.).
PERFORMANCE.—Rated power 150 b.h.p. at 2,650 r.p.m.



The 150 h.p. Praga E engine.

WALTER.

LETECKÉ ZAVODY, NARODNY PODNIK (AVIATION WORKS, NATIONAL CORPORATION).

Zavod-Jinonice (formerly Walter).

HEAD OFFICE AND WORKS: PRAGUE-JINONICE.

Manager: Ing. F. Nušl.

Chief Designer: Ing. B. Šimůnek.

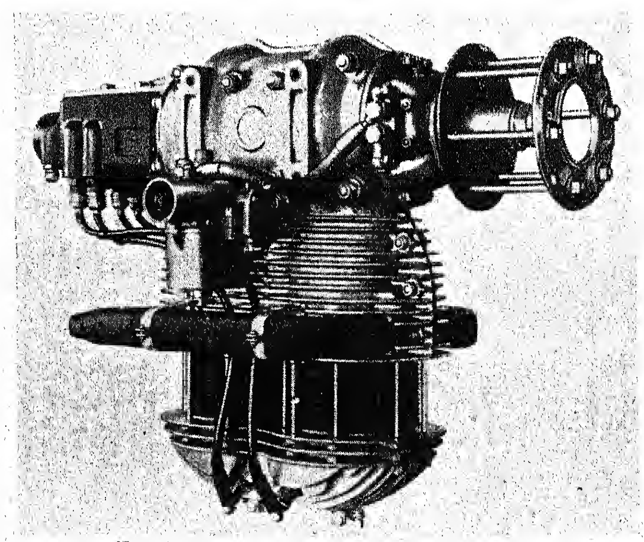
The Walter Aero-engine Works, widely known before the war for their excellent light aircraft engines, were compelled by the German occupying forces to interrupt all construction of Walter engines and to manufacture German Argus engines under licence. In spite of these difficulties Czech engineers carried on secretly during the war with the design of new models so that when Czechoslovakia was liberated the Walter works were able to introduce a number of types of light air-cooled aero-engines suitable for use in training, sporting, touring and light transport aircraft, as well as a new auxiliary engine for sailplanes. These new types are the result of long years of experience gained by the Walter works and incorporate all the latest technical developments.

The Walter company has been nationalised like all the Czechoslovak Aircraft Industry and incorporated into the Letecké Zavody, Narodni Podnik (Aviation Works, National Corporation), with head offices in Prague.

The production of aero-engines has been thoroughly re-organized, mainly as far as methods of construction and design are concerned and a new prototype department has been installed. In addition the factory's very modern workshops have been equipped with the most up-to-date machines and tools which make possible mass-production and assembly of aero-engines on a large scale.

THE WALTER A.

TYPE.—Two-cylinder inverted in-line air-cooled two-stroke.
CYLINDERS.—Bore 86 m/m. (3.39 in.), Stroke 86 m/m. (3.39 in.), Total capacity 0.996 litres (60 cub. in.). Compression ratio 6 : 1. Special fine grain iron centrifugal castings with machined cooling fins and inlet and exhaust ports. One-piece cylinder head for both cylinders is an aluminium-alloy casting. Head with the cylinders attached to the finned lower portion of crankcase by long holding down studs. Compression chambers each provided with one decompression valve.
PISTONS.—With deflectors. Heat-treated Hiduminium RR-53 castings. Four compression rings, locked to prevent rotation. Gudgeon pins secured by spring circlips.
CONNECTING RODS.—I-section chrome steel forgings. Small-ends bronze-bushed. Big-ends run on double roller-bearings.
CRANKSHAFT.—The split crankshaft, a special chrome-vanadium steel forging, consists of three sections splined and bolted together in the crank pins. Two pairs of counter-weights attached to the webs. The crankshaft rotates in three ball-bearings and in a long centre friction bearing provided with ports, which together with the crankshaft centre section, with dividing wall and ports, forms the distributor rotating sleeve for the induction system.
CRANKCASE.—Two vertically divided halves, heat-treated aluminium-alloy castings, bolted together. Lower portion of crankcase continues into finned cylinder jackets with inlet and exhaust stubs fitted by means of clip-fasteners.
INDUCTION SYSTEM.—One horizontal O.B.A. 30 carburettor equipped with choke and fitted directly to the crankcase. Fuel supplied



The 22 h.p. Walter A two-cylinder engine.

***WALTER**—continued.*

to carburettor either by gravity feed or by diaphragm fuel-pump, the latter fitted on special request. The pump can be primed manually.

IGNITION.—A Bosch FM 2-2L magneto for dual unscreened ignition. Two sparking-plugs per cylinder.

LUBRICATION.—Lubrication of bearing surfaces assured by oil mixed with fuel at a proportion of 20 : 1 for running-in and 25 : 1 for normal operation. Front ball thrust-bearing and fuel-pump drive lubricated by oil-bath in the crankcase front-cover. Dip-stick for measuring oil level.

STARTING.—By starting cable and pulley fitted, on special request, in place of the ordinary airscrew hub retaining-plate. For easier starting on the ground and for restarting in flight the decompression valves can be used.

ACCESSORY DRIVES AND EQUIPMENT.—A mounting flange provided on the engine front cover for a diaphragm fuel-pump, driven by a cam from the crankshaft.

MOUNTING.—Engine mounted elastically by means of four engine bearers equipped with rubber vibration dampers.

AIRSCREW DRIVE.—Direct, left-hand tractor (when looking at the engine from the rear). Boss for wooden fixed-pitch airscrew keyed to the tapered crankshaft front end and retained by a nut. Airscrew hub and retaining plate (or starting pulley) attached to boss by six bolts.

FUEL.—Petrol with minimum octane value of 72, mixed with suitable mineral oil for two-stroke engines at a proportion of 20 : 1-25 : 1.

DIMENSIONS.—Overall length including airscrew boss 575 m/m. (22.6 in.), Overall width (including exhaust stubs) 300 m/m. (11.82 in.) Overall height 406 m/m. (16 in.).

WEIGHT DRY (with normal accessories and drives).—25 kg. (55 lbs.) approximate.

PERFORMANCE.—Rated output at sea level 20-22 h.p., Cruising output 15 h.p. at 2,000 r.p.m.

THE WALTER MIKRON III.

TYPE.—Four-cylinder inverted in-line air-cooled, ungeared.

CYLINDERS.—Bore 90 m/m. (3.55 in.), Stroke 96 m/m. (3.78 in.), Total capacity 2.44 litres (149 cub. in.), Compression ratio 6 : 1. Steel cylinders with cooling fins machined from solid. Cylinder bores nitrided. Detachable cylinder-heads are aluminium-alloy castings. Cylinder-head assembly attached to the crankcase by four cylinder holding-down studs.

PISTONS.—Hiduminium RR 53 castings. Three compression rings and one scraper ring. Gudgeon-pins secured by spring circlips.

VALVE GEAR.—One inlet and one exhaust valve per cylinder, of special heat-resisting alloy steel with nitrided stems. Double valve springs. Valves operated by the camshaft through push-rods and rocker-arms. Rockers fitted with needle bearings, with rollers for the valves and valve-clearance adjusting-screws at the push-rod ends. Valve and rocker mechanism on each cylinder enclosed in Elektron cover.

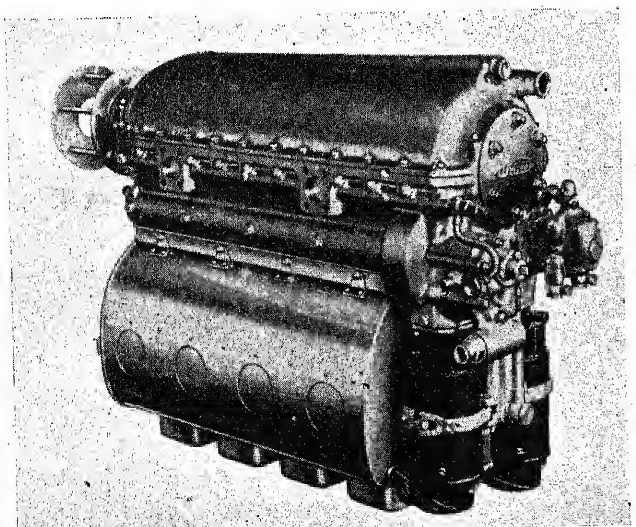
CONNECTING RODS.—H-section, stamped from Hiduminium RR 56, machined all over and polished. Split big-ends provided with steel-backed lead-bronze bearings.

CRANKSHAFT.—Forged from special chromo-vanadium steel, machined all over. Crank pins and journals nitrided. Carried in five steel-backed lead-bronze bearings and a ball thrust-bearing at the front end.

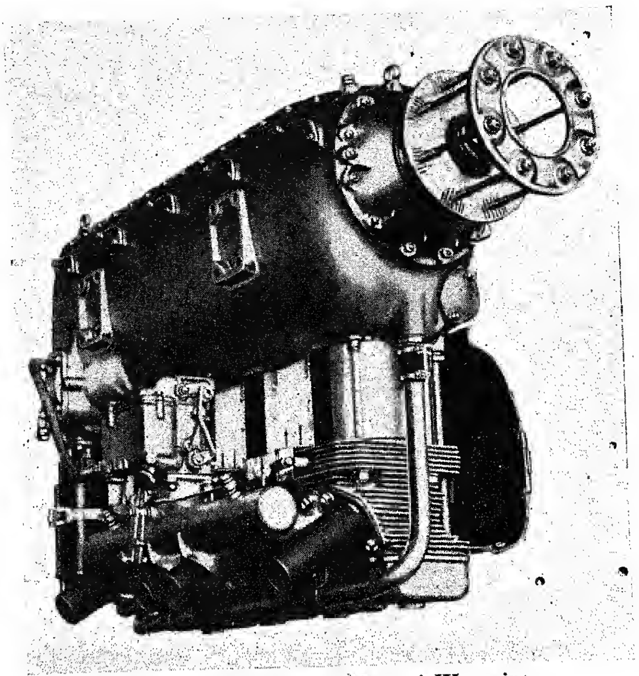
CRANKCASE.—Heat treated magnesium-alloy (Electron) casting.

LUBRICATION.—Dry-sump pressure lubrication. Double gear-type oil-pump with pressure and scavenge stages located at the rear of the crankcase above the sump. Oil drawn from oil tank by pressure pump, provided with an inlet filter, and fed through pressure relief valve directly to crankshaft and camshaft bearings and to the starboard magneto drive-shaft. Oilways in crankshaft lubricate big end bearings. All other moving parts lubricated by splash. Spent oil in sump withdrawn by scavenge pump and returned to oil tank. Union in the pressure line on the crankcase is adapted for pressure-gear connection. The valve-gear works in an oil bath in each rocker cover box. The lubrication system can be modified on request for aerobatic flying, mainly by the addition of an automatic valve to the scavenge line.

INDUCTION SYSTEM.—Walter Hobson AI-37-DX down-draught carburettor with manual mixture control. Cast induction manifold, pre-heated by exhaust gases, fitted with a drain valve and, on



The 65 h.p. Walter Mikron III engine.



The 105 h.p. Walter Minor 4-III engine.

request, with two priming jets. Fuel supplied to the carburettor either by gravity feed or by double diaphragm Walter 2M 50 fuel pump, latter supplied on special request. Pump fitted with a pressure-gauge connection.

IGNITION.—Two Scintilla Vertox magnetos, NVK-4 (port) and AVK-4 (starboard) with automatic sparking advance, placed side-by-side in a hanging position on the crankcase. Starboard magneto provided with impulse unit. Two sparking plugs per cylinder.

COOLING.—Air scoop with an easily removable sliding inspection strip for access to the sparking plugs fitted on port side, with cylinder baffle or deflector on starboard side.

STARTING.—Hand-starting pulley, cable-operated, or hand-starter, type Walter R15, with crank, both supplied on request.

ACCESSORY DRIVES AND EQUIPMENT.—At the rear end of the crankcase. On left-hand side a tachometer drive, D. of R. clockwise, 1/2 engine speed, on right-hand side a fuel-pump mounting-flange and drive, D. of R. clockwise, 1/2 engine speed.

ENGINE MOUNTING.—Engine mounted elastically by means of four engine-bearer feet with rubber vibration dampers, supplied on special request.

AIRSCREW DRIVE.—Direct, left-hand tractor (when looking at the engine from the rear). Boss for fixed-pitch airscrew normally used. Keyed to the tapered crankshaft front end and retained by a nut. Airscrew hub fixed to the boss by means of a retaining plate and six retaining bolts.

DIMENSIONS.—Overall length with airscrew boss 828 m/m. (32.6 in.), Overall width without bearer feet 357 m/m. (14 in.), Overall height 530 m/m. (20.8 in.).

WEIGHT DRY (including normal accessories).—59.3 kg. (130.5 lbs.) ±2 %.

PERFORMANCE (72 Octane fuel).—Rated output at sea level 65 b.h.p. at 2,600 r.p.m., Cruising output 48 b.h.p. at 2,350 r.p.m., Fuel consumption at rated sea level power .245 kg. (.54 lbs.) per h.p./hr., Fuel consumption at cruising power .225 kg. (.49 lbs.) per h.p./hr., Oil consumption .02-.08 kg. (0.44-.176 lbs.) per h.p./hr.

THE WALTER MINOR 4-III.

TYPE.—Four-cylinder inverted in-line air-cooled, ungeared.

CYLINDERS.—Bore 105 m/m. (4.14 in.), Stroke 115 m/m. (4.53 in.), Total capacity 3.98 litres (244 cub. in.), Compression ratio 6 : 1. Steel cylinders with cooling fins machined from solid. Cylinder bores nitrided. Detachable cylinder-heads are aluminium-alloy castings. Cylinder and head assembly attached to crankcase by four cylinder holding-down studs.

PISTONS.—Hiduminium RR 59 stampings. Three compression rings and one scraper ring. Gudgeon-pins secured by spring-circlips.

VALVE GEAR.—Same as for Mikron III.

CONNECTING RODS.—H-section, stamped from Hiduminium RR 56, machined all over and polished. Split big-ends provided with steel-backed lead-bronze bearings.

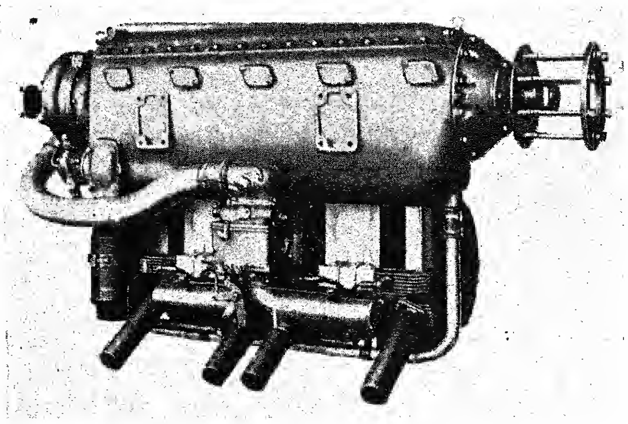
CRANKSHAFT.—Forged from special chrome-vanadium steel, machined all over. Crank-pins and journals nitrided. Carried in five steel-backed lead-bronze bearings and a ball thrust-bearing at the front end.

CRANKCASE.—Heat-treated magnesium-alloy casting.

LUBRICATION.—Dry sump pressure lubrication. For description see Mikron III.

INDUCTION SYSTEM.—Walter 45 down-draught carburettor with manual mixture control, acceleration pump and special jet for inverted flight. Cast induction manifold, pre-heated by exhaust gases, fitted with two priming jets and with a drain valve. A hot and cold air intake controllable from the cockpit, fitted on special request. Cold air passes directly to the carburettor, warm air is drawn from the cylinders through a flame trap. Fuel supplied to the carburettor either by a gravity feed or by double diaphragm Walter 2M 50 fuel-pump, latter supplied on special request. Pump fitted with a pressure-gauge connection.

WALTER—*continued.*



The 105 h.p. Walter Minor 4-III S engine.

IGNITION.—Dual unscreened ignition ; two Scintilla Vertex magnetos. NVK-4 (port) and AVK-4 (starboard), with automatic sparking advance. If desired a screened ignition can be supplied. Magnetos placed side-by-side in a hanging position at the rear of the crank-case. Starboard magneto provided with impulse unit. Two sparking plugs per cylinder.
COOLING.—Cylinder cooling air-scoop and baffle plates as for Mikron III.
STARTING.—Electric and hand starter with crank, type Walter RE 25, supplied on request.
ACCESSORY DRIVES AND EQUIPMENT.—On the rear end of the crank-case ; left-hand a tachometer drive (D. of R. clockwise, 1/2 engine speed) ; right-hand a fuel-pump mounting-flange and drive (D. of R. clockwise, 1/2 engine speed). On the port and starboard side of the crankcase can be fitted either a directly-driven 24-volt 100 watt. generator, or a flexible shaft for a remotely-driven generator ; to the starboard flange a flexible shaft for a second generator can be fitted.
MOUNTING.—Four engine bearer feet with rubber vibration dampers, supplied on special request.
AIRSCREW DRIVE.—Direct, left-hand tractor (when looking at the engine from the rear). Boss for wooden fixed-pitch airscrew is normally used. Keyed to the tapered crankshaft front-end and retained by a nut. Airscrew hub attached to boss by retaining plate and eight retaining bolts.
DIMENSIONS.—Overall length with airscrew boss 1,032 m/m. (40.56 in.), Overall width without bearer feet 399 m/m. (15.6 in.), Overall height 630 m/m. (24.7 in.).
WEIGHT DRY (including normal accessories).—90.5 kg. (199 lbs.) ±2%.
PERFORMANCE (72 Octane fuel).—Rated output at sea level 105 b.h.p. at 2,500 r.p.m., Cruising output 80 b.h.p. at 2,300 r.p.m., Fuel consumption at rated sea level power .245 kg. (.54 lbs.) per h.p./hr., Fuel consumption at cruising power 225 kg. (.49 lbs.) per /h.p./hr., Oil consumption .02-.08 kg. (.044-.176 lbs.) per/h.p./hr.

THE WALTER MINOR 4-III S.

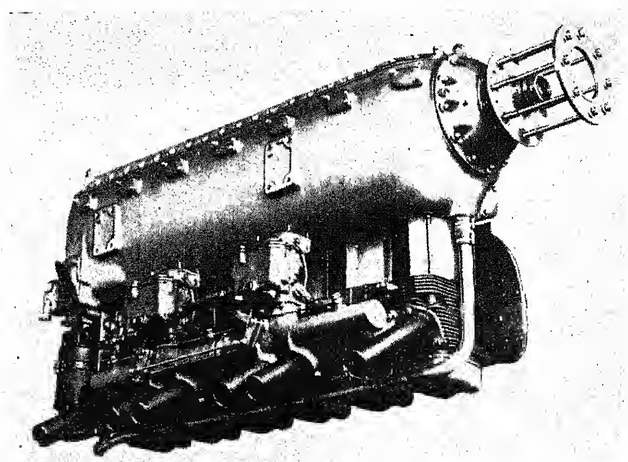
The Minor 4-III S is identical to the Minor 4-III, but is equipped with a centrifugal supercharger to increase take-off power, climbing performance and ceiling. The compressor can be de-clutched if desired. Only in the following details does the engine differ from the Minor 4-III.
CRANKSHAFT.—The crankshaft rear end carries the driving part of the supercharger coupling instead of the starter dog.
SUPERCHARGER.—Centrifugal supercharger fitted to a flange on the rear wall of the crankcase. Impeller, a Hiduminium RR 56 forging, is driven from the rear end of the crankshaft by means of an elastic coupling and an epicyclic gear at a ratio of 1 : 7.4. Impeller drive can be de-clutched by means of a band-brake gripping or releasing the outer wheel of the epicyclic gear, this brake being controllable from the cockpit. Pressure lubrication of all gears. Compressed air fed to the carburettor through an aluminium pipe connected to the carburettor by means of an elbow with suitable guide vanes.
STARTING.—Rear part of the supercharger casing contains a starter dog and hand-cranking gear with safety catch (protecting the hand crank) and a worm gear for an electric-starter. Normally hand-starting equipment is supplied. An electric-starter is optional.
The supercharger driving gear forms part of the reduction gear for the starter unit and the supercharger band-brake acts as safety clutch in case of backfiring.
FUEL.—80 Octane.
WEIGHT DRY (including normal accessories and hand-starter).—97.5 kg. (214.5 lbs. ± 2%.
LENGTH.—Overall (with airscrew boss) 1,172 m/m. (46.1 in.).

THE WALTER MINOR 6-III.

TYPE.—Six-cylinder inverted in-line air-cooled, ungeared.
CYLINDERS.—Bore 105 m/m. (4.14 in.), Stroke 115 m/m. (4.53 in.), Total capacity 5.97 litres (364.17 cub. in.), Compression ratio 6 : 1.
CRANKSHAFT.—Carried in seven steel backed lead-bronze bearings and in a ball thrust bearing at the front end.
INDUCTION SYSTEM.—Two Walter 45 down-draught carburettors with manual mixture control, an acceleration pump and a special jet fitted to the induction manifold for inverted flight. Manifold, made up to two aluminium-alloy castings, pre-heated by exhaust gases and fitted with two priming jets and with a drain valve. Hot and cold air intakes, controllable from the cockpit, fitted on special request. Cold air passes directly to the carburettors, warm air drawn from the cylinders through flame traps. Fuel supplied to the carburettors either by a gravity feed or by a Walter 2M 50 double-diaphragm fuel-pump, latter supplied on special request. Pump fitted with pressure-gauge connection.
IGNITION.—Two Scintilla Vertex magnetos, NVK-6 (port) and NVK-6 (starboard), with automatic sparking advance. Screened ignition optional. Magnetos placed side-by-side in a hanging position at the rear of the crankcase. Starboard magneto provided with an impulse unit. Two sparking-plugs per cylinder.
DIMENSIONS.—Overall length with airscrew boss 1,324 m/m. (52.1 in.), Overall width without bearer feet 399 m/m. (15.6 in.), Overall height 630 m/m. (24.7 in.).
WEIGHT DRY (including normal accessories).—135 kg. (297 lbs.) ± 2%.
PERFORMANCE (72 Octane fuel).—Rated output at sea level 160 b.h.p. at 2,500 r.p.m., Cruising output 120 b.h.p. at 2,300 r.p.m., Fuel consumption at rated power 245 kg. (.54 lb.) per h.p./hr., Fuel consumption at cruising power 225 kg. (.49 lbs.) per h.p./hr., Oil consumption .02-.08 kg. (.044-.176 lbs.) per h.p./hr.

THE WALTER MINOR 6-III S.

The Minor 6-III S is identical to the Minor 6-III except that it is equipped with a centrifugal supercharger similar to that fitted to the Minor 6-III S. Only the following details are different.
CRANKSHAFT.—The crankshaft rear end carries the driving part of the supercharger coupling instead of the starter dog.
SUPERCHARGER.—Same as for Minor 4-III S. Compressed air fed to carburettors by a pipe connected to the carburettors by means of elbows with suitable guide vanes.
STARTING.—Same as for Minor 4-III S.
FUEL.—80 Octane.
WEIGHT DRY (including normal accessories and hand-starter).—142 kg. (312 lbs.) ±2%.
LENGTH OVERALL (with airscrew boss) 1,464 m/m. (57.6 in.).



The 160 h.p. Walter Minor 6-III engine.

ZLIN.

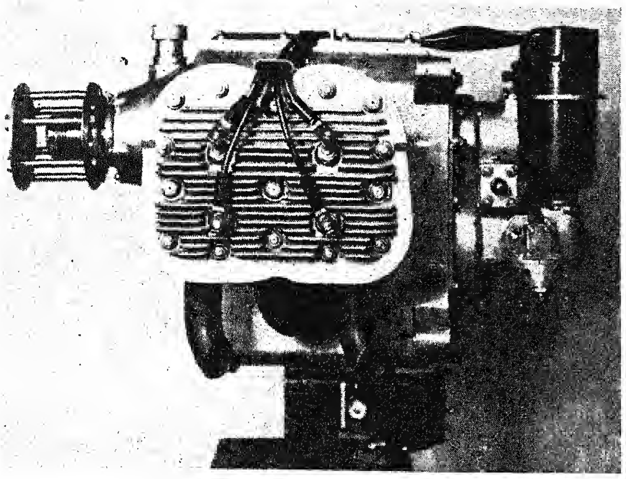
AUTOMOBILOVE ZAVODY, NARODNI PODNIK (Motorcar Works, National Corporation).
Zavod Otrokovice (formerly Zlinska Letecka A.S.).
HEAD OFFICE : ZLÍN.
WORKS : OTROKOVICE, NEAR ZLÍN.
Managing Director : Ing. Smela.

The original Zlinska Letecka A.S. was formed in 1935 by the well-known Bata boot and shoe manufacturing company and built both Zlin aircraft and light engines suitable for use in its own aircraft. It has now been incorporated in the new nationalised corporation and has resumed production of the Persy and Toma air-cooled engines.

THE PERSY 3.

TYPE.—Four-cylinder horizontally-opposed air-cooled.
CYLINDERS.—Bore 95 m/m. (3.7 in.), Stroke 95 m/m. (3.7 in.), Capacity 2,700 cub. c/m. (164.7 cub. in.), Compression ratio 6 : 1. Cast-iron cylinder barrels. One cylinder head, of cast aluminium-alloy, for each pair of cylinders.
PISTONS.—Special aluminium-alloy stampings.
CONNECTING RODS.—Aluminium-alloy stampings. Lead-bronze bearings.
CRANKSHAFT.—Special steel forging. Four lead-bronze bearings.
CRANKCASE.—Magnesium-alloy casting in one piece, includes oil-sump.
VALVE GEAR.—Two side valves per cylinder.
CARBURATION.—Zenith carburetter.
IGNITION.—Two Scintilla Vertex magnetos.
LUBRICATION.—Oil drawn from sump through filter and supplied by pressure to all bearings. Oil pressure controlled by regulating valve.
EQUIPMENT.—Starter, fuel pump, tachometer drive, four bearer-feet.
DIMENSIONS.—Length overall 800 m/m. (31.2 in.), Width overall 820 m/m. (31.9 in.), Height 510 m/m. (19.8 in.).
WEIGHT DRY (with normal equipment).—70 kg. (154.3 lbs.).

ZLIN—*continued.*

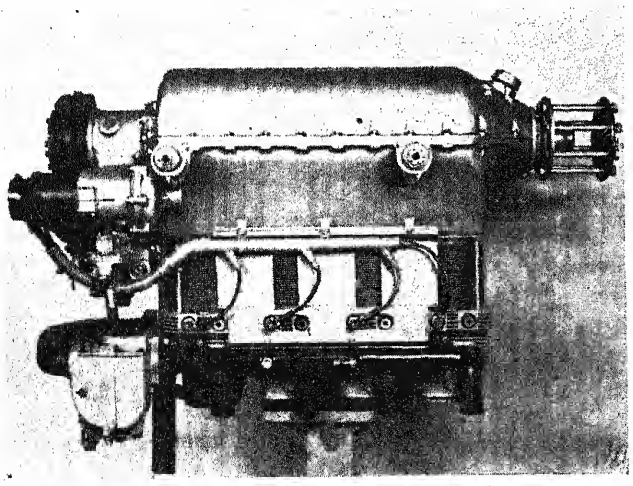


The 65 h.p. Zlin Persy III engine.

PERFORMANCE.—Rated power at sea level 57 h.p. at 2,470 r.p.m., Maximum power at sea level (10 min. only) 65 h.p. at 2,600 r.p.m., Cruising power 50 h.p. at 2,350 r.p.m., Fuel consumption at rated power 0.23 kg. (0.5 lbs.) per h.p./hr., Oil consumption 0.005 kg. (0.011 lbs.) per h.p./hr.

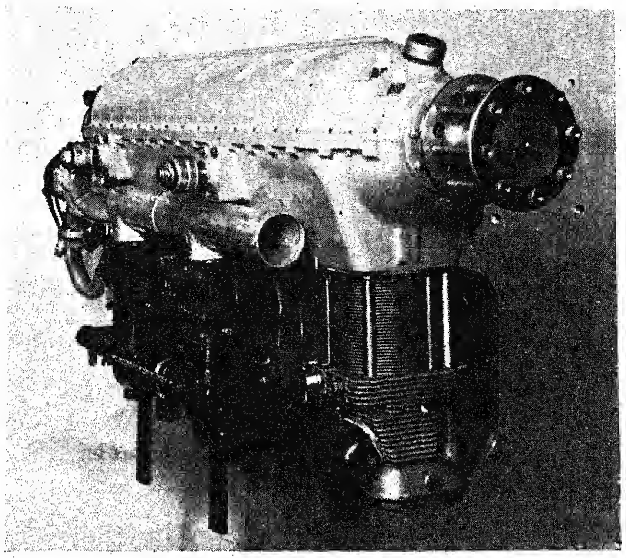
THE TOMA 4.

TYPE.—Four-cylinder in-line inverted air-cooled.
CYLINDERS.—Bore 105 m/m. (4.13 in.), Stroke 115 m/m. (4.427 in.), Capacity 4,000 cub. c/m. (244 cub. in.), Compression ratio 6 : 1. Barrels are steel forgings, cylinder heads aluminium-alloy castings.



The 106 h.p. Zlin Toma 4 engine.

PISTONS.—Aluminium-alloy castings.
CONNECTING RODS.—Aluminium-alloy stampings.
CRANKSHAFT.—Special steel forging. Five lead-bronze bearings and thrust ball-bearing.
CRANKCASE.—Two-piece case. Magnesium-alloy castings.
CARBURATION.—Zenith HM 50 or SUM 729 carburettor.
IGNITION.—Two Scintilla Vertex magnetos. Two sparking-plugs per cylinder.
LUBRICATION.—Dry-sump pressure lubrication.
EQUIPMENT.—Hand-starter, fuel pump, air-heater, generator, four bearer-feet with rubber vibration dampers.
DIMENSIONS.—Length overall 1,100 m/m. (42.9 in.).
WEIGHT DRY (with normal equipment).—95 kg. (209.4 lbs.).
PERFORMANCE.—Rated power at sea level 94 h.p., Maximum power at sea level (10 min. only) 106 h.p. at 2,520 r.p.m., Cruising power 80 h.p. at 2,100 r.p.m., Fuel consumption at rated power 0.23 kg. (0.5 lbs.) per h.p./hr., Oil consumption 0.005 kg. (0.011 lbs.) per h.p./hr.



The 155 h.p. Zlin Toma 6 engine.

THE TOMA 6.

TYPE.—Six-cylinder in-line inverted air-cooled.
CYLINDERS, PISTONS AND CONNECTING RODS.—Same as for Toma 4.
CRANKSHAFT.—Six-throw. Nitrided steel forging.
CARBURATION.—Solex 40 carburettor.
IGNITION.—Two Scintilla Vertex magnetos. Two sparking-plugs per cylinder.
LUBRICATION.—Dry-sump pressure lubrication. Laminated oil-filter.
EQUIPMENT.—Compressed-air starter.
DIMENSIONS.—Length overall 1,415 m/m. (55.18 in.), Height overall 612 m/m. (23.86 in.).
WEIGHT DRY (with normal equipment).—140 kg. (308.5 lbs.).
PERFORMANCE.—Maximum power at sea level 155 h.p. at 2,550 r.p.m., Cruising power 125 h.p. at 2,250 r.p.m., Fuel consumption 0.23 kg. (0.5 lbs.) per h.p./hr., Oil consumption 0.0049 kg. (0.011 lbs.) per h.p./hr.

FRANCE

GAS TURBINE ENGINES

HISPANO-SUIZA.

SOCIÉTÉ HISPANO-SUIZA.

Head Office and Works: Bois Colombes (Seine).

The Hispano-Suiza company has entered the turbo-jet engine field by acquiring the licence to build the Rolls-Royce Nene engine, and engines of this type have been specified for a number of French prototype aircraft. For full details of the Nene, see under "Rolls-Royce."

RATEAU.

SOCIÉTÉ RATEAU.

Address: c/o Société Nationale D'Etude et de Construction de Moteurs d'Aviation, 150, Boulevard Haussmann, Paris (8e).

The Société Rateau, well-known for its work with turbo-superchargers, began the development of turbo reaction motors in 1939. During the German occupation clandestine work continued under considerable difficulties, small parties of engineers who were engaged in the project being compelled to work more or less independently in order to minimise the risk of detection. After the liberation the results of their work was co-ordinated and with the assistance of the Air Ministry work was almost immediately begun on the construction of the first Rateau turbo-jet engine.

This engine, which is undergoing trials, is briefly described below. Its development is being undertaken by the Société Nationale d'Etude and de Construction de Moteurs d'Aviation.

THE RATEAU A.65 GAS TURBINE.

The A.65 gas turbine, the design of which is based on patents taken out in 1939 by M. Anxionnaz, comprises an axial compressor with four low-pressure and twelve high-pressure stages, nine reverse-flow combustion chambers grouped round the compressor casing, and a two-stage turbine.

Primary air passes through all stages of compression and the turbine. Secondary air after passing through the low-pressure stages is by-passed to a point aft of the turbine where extra fuel can be injected for after burning.

Dimensions.—Overall length 2.407 m. (94.7 in.), Maximum diameter 1.240 m. (48.7 in.).

Weight Dry.—1,000 kg. (2,200 lbs.).

Performance.—Static thrust at sea level 820 kg. (1,760 lbs.) or 900 kg. (1,980 lbs.) with after-burning, at 7,500 r.p.m.

TURBOMECA.

SOCIÉTÉ TURBOMECA.

Head Office and Works: Bordes (Basses-Pyrenées).

The Société Turbomeca was formed in 1938 by MM. Szydlowski and Planiol to develop blowers, compressors and turbines for aeronautical use. Just prior to the outbreak of war the company received an Air Ministry contract for a large number of turbo-compressors for Hispano-Suiza engines intended for installation in Dewoitine fighter monoplanes then going into production.

In June, 1940, the company was instructed to move from Billancourt to Bordes, where after the Armistice it was able to continue the manufacture of compressors for the Hispano-Suiza engine. In all, some 1,500 were built.

In 1941 a small aircraft turbo-reaction motor to develop the equivalent of 200 h.p. was designed but its construction could not be undertaken because of the German occupation. The company suffered from the depradations of the enemy and it was not until the end of 1944 that is was able to re-equip its factory.

Production of turbo-compressors, particularly for Hispano-Suiza and Gnôme-Rhône engines continues. The company is also engaged in gas-turbine research and development, M. Szydlowski now having under his direction a number of German technicians who were formerly with the B.M.W. company.

During 1946, the company was engaged in the design of a large axial-flow turbo-jet engine with a designed thrust of 7,000 kg. (15,400 lbs.). No details of this engine are available for publication.

INTERNAL COMBUSTION ENGINES

ARSENAL.

ARSENAL DE L'AÉRONAUTIQUE.

Head Office: 12, Rue Béranger, Chatillon-sous-Bagneux (Seine).

The State-owned Arsenal de l'Aéronautique has developed a twenty-four cylinder H-type liquid-cooled engine of high output which is largely made up of components of the German Junkers Jumo 213 engine, including cylinder barrels, cylinder heads, valve-gear, crankshafts, Bosch fuel-injection and the Junkers single-control system.

The first engine built, known as the Arsenal 24H, was fitted with a simple reduction gear driving a single airscrew, but a double gear has been developed to permit the use of contra-rotating airscrews.

Another development of the Arsenal is a tandem 24H installation driving co-axial oppositely-rotating airscrews. The two 24H engines are disposed one behind the other, the rear engine driving the forward of the two airscrews by a shaft which passes through the axis of the forward engine. The forward engine drives the rear airscrew. The two engines are independent of one another and their distance apart may be adjusted to suit installation requirements. The S.N.C.A. Sud-Est S.E.1200 long-range flying-boat now being built will be fitted with four tandem 24H units, each developing 8,000 h.p.

THE ARSENAL 24H.

Type.—Twenty-four cylinder H-type liquid-cooled, geared and supercharged.

Cylinders.—Bore 150 m/m. (5.9 in.), Stroke 165 m/m. (6.5 in.), Capacity 70 litres, Compression ratio 6.5 : 1.

Crankcase.—Horizontal H-shaped light-alloy casting with side covers giving direct access to crankshafts and bearings. Cylinder coolant jackets cast integral with case.

Superchargers.—Two two-speed centrifugal blowers mounted with drives at right angles to engine axis, the port blower serving the upper cylinder blocks and the starboard blower the lower blocks. Ratios 6.90 and 9.14 : 1.

Reduction Gear.—Spur-type. Ratio 2.4 : 1. Long gear casing to permit mounting of annular coolant radiator between airscrew and cylinder blocks. Either single or two co-axial airscrews.

Fuel Injection.—Bosch injection pumps and injectors.

Dimensions.—Length 3.020 m. (118.80 in.), Height 1.500 m. (59.04 in.), Width 1.200 m. (47.16 in.).

Weight Dry.—1,850 kg. (4,070 lbs.).

Performance.—Take-off output 4,000 h.p. at 3,250 r.p.m., Normal output at sea level 3,400 h.p. at 3,000 r.p.m., Normal output at rated height 3,000 h.p. at 3,000 r.p.m., Cruising output 2,700 h.p. at 2,700 r.p.m.

THE ARSENAL 24H TANDEM.

This installation consists of two 24H engines and transmission system to drive two co-axial oppositely-rotating airscrews, the front airscrew driven by the rear engine and the rear airscrew by the front engine. The transmission system has been the subject of considerable development by the Arsenal de l'Aéronautique and is adaptable to many different applications in which the position of the two engines and the reduction gearing and airscrew drive may be varied to suit various types of installations.

The following figures refer to the 24H tandem unit as exhibited at the 1946 Paris Aero Show:—

Weight Dry.—3,850 kg. (8,470 lbs.).

Performance.—Take-off output 7,200 h.p., Normal output 6,400 h.p. at 3,000 r.p.m.

Other applications of the Arsenal tandem transmission have been with two Hispano-Suiza 12Z engines, which installation forms the power-plant of the Arsenal VB.10 single-seat fighter, and with two Junkers Jumo 213 engines which in combination develop an output of 4,000 h.p. for a weight of 2,450 kg. (5,390 lbs.).

ASTER.

ATELIERS DE CONSTRUCTIONS MÉCHANIQUES L'ASTER.

Head Office: 4, Rue du Général Foy, Paris.

Works: 102, Rue de Paris, Saint-Denis (Seine).

This well-known manufacturer of Aster-Diesel engines for industrial purposes has acquired the licence to build the Walter Mikron four-engined in-line inverted air-cooled engine from the Czechoslovak Walter company, now a nationalised concern. The engine is being marketed in France as the Aster Mikron. For a description of the engine see under "Walter" (Czechoslovakia).

BÉARN. (See S.C.E.M.M.)

BLOCH.

SOCIÉTÉ DES AVIONS MARCEL BLOCH.

Head Office: 46, Avenue Kleber, Paris.

The Société des Avions Bloch has developed a low-priced four-cylinder in-line inverted air-cooled engine, of which but a few details were available at the time of writing. With a capacity of 7 litres the Bloch 4B2 engine has a take-off power of 220 h.p. at 2,600 r.p.m., a normal output at sea level of 160 h.p. at 2,500 r.p.m. and 175 h.p. at 2,500 m. (8,200 ft.) The dry weight of the 4B2 is 190 kg. (396 lbs.).

GNÔME-RHÔNE (See S.N.E.C.M.A.)

HISPANO-SUIZA.

SOCIÉTÉ D'EXPLOITATION DES MATERIELS HISPANO-SUIZA.

HEAD OFFICE AND WORKS: BOIS COLOMBES (SEINE).

The Hispano-Suiza company, well-known before the war as the producer of high-performance liquid-cooled engines mainly for military use, has resumed production of its pre-war twelve-cylinder 60° Vee liquid-cooled engine under the designation 12Z and has also revived its twenty-four "H" engine which was first introduced at the 1938 Paris Aero Show. Both engines now incorporate direct fuel-injection.

The company has also acquired the licence to build the Rolls-Royce Nene turbo-jet engine.

THE HISPANO-SUIZA 12Z.

TYPE.—Twelve-cylinder 60° Vee liquid-cooled, geared and supercharged.

CYLINDERS.—Bore 150 m/m. (5.9 in.), Stroke 170 m/m. (6.7 in.), Capacity 36 litres, Compression ratio 7 : 1. Each block of six cylinders is a single alloy casting bolted to crankcase. Open-ended steel barrels are nitrided inside and are screwed at upper ends into cylinder blocks. Special sealing rings at upper and lower ends. Portions of walls directly in contact with coolant are cadmium-plated. Coolant fed into tops of blocks by longitudinal tube pieced to distribute liquid at hottest points.

VALVE GEAR.—Four valves per cylinder, two inlet and two sodium-cooled exhaust. Valves operated directly by two overhead camshafts per cylinder block. Stellited valve seats. Double springs.

CRANKSHAFT.—One-piece six-throw nickel-chrome steel forged shaft carried on seven bearings.

REDUCTION GEAR.—Spur-gear type. Ratio 0.6 : 1. Straight-toothed crown wheel on hollow airscrew shaft driven pinion solid with crankshaft. Raised airscrew shaft makes possible the installation of a cannon in the cylinder Vee.

SUPERCHARGER.—Turbomeca type PV.19B two-speed turbo compressor driven through centrifugal clutch and train of gears. Ratios 6.31 and 9.38 : 1. Automatic speed change by barometric capsule. Air trunk in cylinder Vee.

FUEL INJECTION.—Direct injection into cylinder heads. Two Lavalette P-1511-AS2 six-piston pumps, one for each cylinder block and mounted on the outside of the block. One Lavalette type KFD injector per cylinder. Injection pressure 40 kg./sq. c/m.

IGNITION.—Two R.B. J.12 twelve-cylinder magnetos mounted forward on reduction gear casing. Two plugs per cylinder. Fully screened ignition system.

FUEL.—100/130 Grade.

LUBRICATION.—Pressure.

STARTER.—Air-Equipement type 1525 compressed-air starter.

DIMENSIONS.—Overall length 2.384 m. (93.83 in.), Height 1.074 m. (42.26 in.), Width 0.744 m. (29.28 in.).

WEIGHT DRY.—620 kg. (1,364 lbs.).

PERFORMANCE.—Take-off output 1,800 h.p. at 2,800 r.p.m., Combat output (5 mins.) 1,600 h.p. at 2,800 r.p.m. at 2,500 m. (8,200 ft.) in M.S. gear and 1,300 h.p. at 2,800 r.p.m. at 8,000 m. (26,240 ft.) in H.S. gear, Maximum continuous output 1,500 h.p. at 2,600 r.p.m. at 2,500 m. (8,200 ft.) in M.S. gear and 1,250 h.p. at 2,600 r.p.m. at 7,500 m. (24,600 ft.) in H.S. gear, Cruising output 900 h.p. at 2,100 r.p.m. at 3,000 m. (9,840 ft.) in M.S. gear and at 5,600 m. (18,370 ft.) in H.S. gear.

THE HISPANO-SUIZA 24Z.

The 24Z is a twenty-four cylinder vertical "H" engine which makes use of many of the components of the 12Z. The engine comprises two vertical twelve-cylinder units, each unit being completely autonomous and capable of functioning independently of the other. The two crankshafts drive through straight spur gearing two oppositely-turning co-axial airscrews, the gear assembly being mounted to permit the installation of a cannon between the upper pairs of cylinder blocks to fire through the inner airscrew shaft.

TYPE.—Twenty-four-cylinder H-type liquid-cooled, geared and supercharged.

CYLINDER BLOCKS, PISTONS, CONNECTING RODS, VALVE GEAR AND CRANKSHAFTS.—Same as for 12Z.

CRANKCASE.—Aluminium-alloy case split on the horizontal centre-line.

REDUCTION GEAR.—Spur-gear type. Ratio 0.44 : 1. Straight-toothed pinion wheels on crankshafts drive concentric gears on separate oppositely-rotating co-axial airscrew shafts.

SUPERCHARGER.—Two two-speed compressors. Ratios 6.72 and 9.52 : 1. Automatic speed change by barometric capsules. Four separate trunk pipes take air from blowers to upper and lower banks of cylinders on their respective sides.

FUEL INJECTION.—Two Lavalette type EPE-11/1-EG twelve-piston pumps, one on each side of engine. One Lavalette type EIP injector per cylinder. Injection pressure 40 kg./sq. c/m.

IGNITION.—Four R.B. J.12 twelve-cylinder magnetos mounted at the back of the engine. Two sparking-plugs per cylinder. Fully-screened ignition system.

LUBRICATION.—Pressure.

FUEL.—100/130 Grade.

STARTER.—Air Equipement type 51003 electric/inertia starter.

DIMENSIONS.—Overall length 3.268 m. (128.64 in.), Height 1.385 m. (54.48 in.), Width 1.300 m. (51.12 in.).

WEIGHT DRY.—1,450 kg. (3,190 lbs.).

PERFORMANCE.—Take-off output 3,600 h.p. at 2,800 r.p.m., Combat output (5 min.) 3,200 h.p. at 2,800 r.p.m. at 2,500 m. (8,200 ft.) in M.S. gear and 2,600 h.p. at 2,800 r.p.m. at 8,000 m. (26,240 ft.) in H.S. gear, Maximum continuous output 3,000 h.p. at 2,600 r.p.m. at 2,500 m. (8,200 ft.) in M.S. gear and 2,500 h.p. at 2,600 r.p.m. at 7,500 m. (24,600 ft.) in H.S. gear, Cruising output 1,800 h.p. at 2,100 r.p.m. at 3,000 m. (9,840 ft.) in M.S. gear and 1,800 h.p. at 2,100 r.p.m. at 5,600 m. (18,370 ft.) in H.S. gear.

MATHIS.

MATHIS S.A., DIVISION AVIATION.

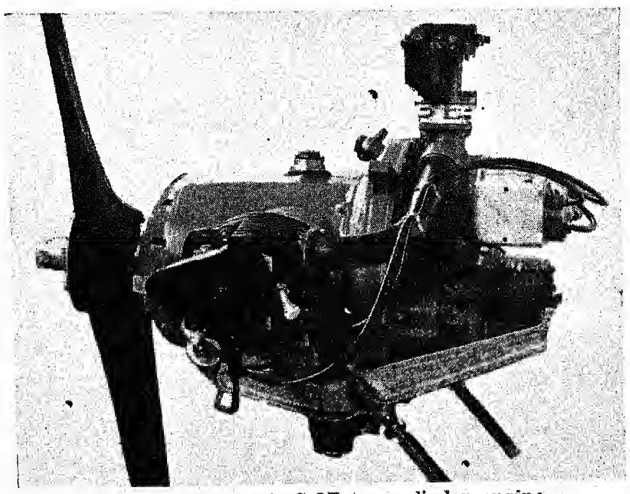
HEAD OFFICE: 145, AVENUE DE MALAKOFF, PARIS (XXIe).
WORKS: RUE DE LA BONGARDE, GENNEILIVERS (SIENE).

Managing Director: H. Cantoni.
Technical Director: R. Georges.

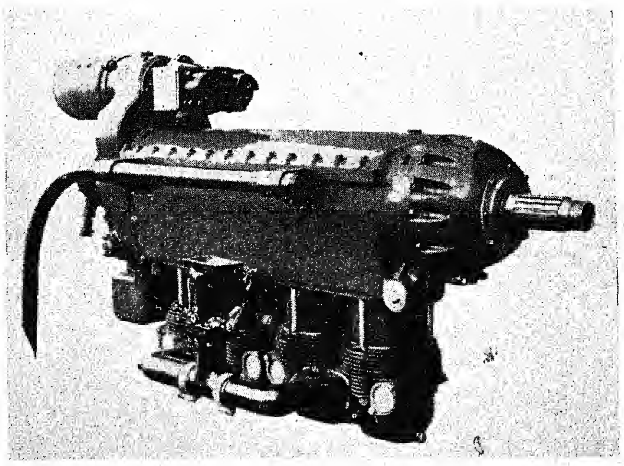
In 1937 the Aviation Division of Mathis S.A. developed a large forty-two-cylinder six-row air-cooled radial engine of 59 litres (2,952 cub. in.) capacity and rated at 2,300 h.p. at 3,200 r.p.m. on a weight of 1,080 kg. (2,376 lbs.). The excellent dynamic balance and high power per sq. m. of frontal area of this engine encouraged the company to begin the study of a larger engine of the same type—the Vesta, of 120 litres (6,000 cub. in.) capacity and with a designed output of 5,000 h.p. The outbreak of war put a stop to this development.

In 1942 during the occupation the company began clandestinely to develop a series of engines of from 32 to 500 h.p. to make use of the greatest possible number of standard components. Cylinders, cylinder-heads, valves, valve-springs and valve-rockers are common to all engines. Each engine may be supplied with or without reduction-gear.

This G Series of engines includes the 40 h.p. G.2F, the 75 h.p. G.4F; the 76 h.p. G.4 and 100 h.p. G.4R; the 135 h.p. G.7 and 175 h.p. G.7R; the 150 h.p. G.8 and 210 h.p. G.8R and the 350 h.p. G.14R and 500 h.p. G.14RS. The number indicates the number of cylinders, the letter F indicates "flat-twin," R indicates reduction-gear and S supercharger. The principal characteristics of these engines are detailed below.



The 40 h.p. Mathis G.2F two-cylinder engine.



The 100 h.p. Mathis G.4R four-cylinder engine.

THE MATHIS G.2F.

TYPE.—Two-cylinder horizontally-opposed air-cooled.

CYLINDERS.—Bore 96 m/m. (3.78 in.), Stroke 100 m/m. (3.94 in.), Capacity 1,507 litres (92 cub. in.), Compression ratio 6.6 : 1.

ACCESSORIES.—Zenith carburettor, dual ignition, Guiot fuel pump.

AIRSCREW DRIVE.—Direct. R.H. rotation.

DIMENSIONS.—Length 550 m/m. (21.65 in.), Height 350 m/m. (13.69 in.), Width 789 m/m. (31.10 in.).

DRY WEIGHT.—55 kg. (121.2 lbs.).

PERFORMANCE.—Maximum output 40 h.p. at 2,700 r.p.m., Normal rated output 38 h.p. at 2,550 r.p.m., Cruising output 23 h.p. at 2,250 r.p.m., Fuel consumption 225 gr. (.495 lbs.) per h.p./hr.; Oil consumption 5 gr. (.011 lbs.). per hp./hr.

THE MATHIS G.4F.

TYPE.—Four-cylinder horizontally-opposed air-cooled.

CYLINDERS.—Bore 96 m/m. (3.78 in.), Stroke 100 m/m. (3.94 in.), Capacity 3,014 litres (184 cub. in.), Compression ratio 6.6 : 1.

ACCESSORIES.—Zenith carburettor, dual ignition, Guiot petrol pump.

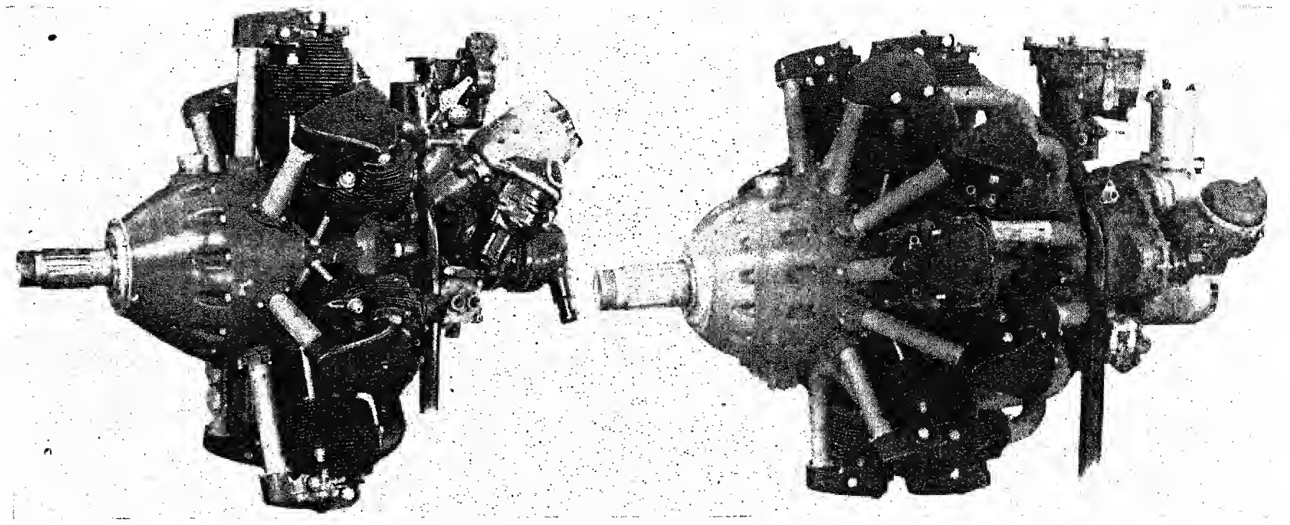
AIRSCREW DRIVE.—Direct. R.H. rotation.

DIMENSIONS.—Length 800 m/m. (31.5 in.), Height 400 m/m. (15.75 in.), Width 800 m/m. (31.5 in.).

DRY WEIGHT.—80 kg. (176 lbs.).

PERFORMANCE.—Maximum output 75 h.p. at 2,550 r.p.m., Normal rated output 72 h.p. at 2,500 r.p.m., Cruising output 50 h.p. at 2,200 r.p.m., Fuel consumption 225 gr. (.495 lbs.) per h.p./hr., Oil consumption 5 gr. (.011 lbs.) per h.p./hr.

MATHIS—*continued.*



The 175 h.p. Mathis G.7 seven-cylinder (left) and the G.14R fourteen-cylinder (right) radial air-cooled engines.

THE MATHIS G.4 AND G.4R.

Type.—Four-cylinder in-line inverted air-cooled, direct-drive (G.4) or geared (G.4R).
Cylinders.—Bore 96 m/m. (3.78 in.), Stroke 100 m/m. (3.94 in.), Capacity 3.014 litres (184 cub. in.), Compression ratio 7.1 : 1.
Accessories.—Zenith carburretor, dual ignition, Guiot fuel pump.
Airscrew Drive (G.4).—Direct.
Airscrew Drive (G.4R).—Epicyclic reduction gear 0.63 : 1 ratio.
Dimensions.—Length 1,241 m/m. (48.8 in.), Height 630 m/m. (24.8 in.), Width 402 m/m. (15.76 in.).
Weight Dry (G.4).—95 kg. (209 lbs.).
Weight Dry (G.4R).—102 kg. (224.4 lbs.).
Performance (G.4).—Maximum output 76 h.p. at 2,550 r.p.m., Normal rated output 72 h.p. at 2,500 r.p.m., Cruising output 50 h.p. at 2,200 r.p.m., Fuel consumption 225 gr. (.495 lbs.) per h.p./hr., Oil consumption 5 gr. (0.11 lbs.) per h.p./hr.
Performance (G.4R).—Maximum output 100 h.p. at 3,500 r.p.m., Normal rated output 85 h.p. at 3,100 r.p.m., Cruising output 65 h.p. at 2,850 r.p.m.

THE MATHIS G.7 AND G.7R.

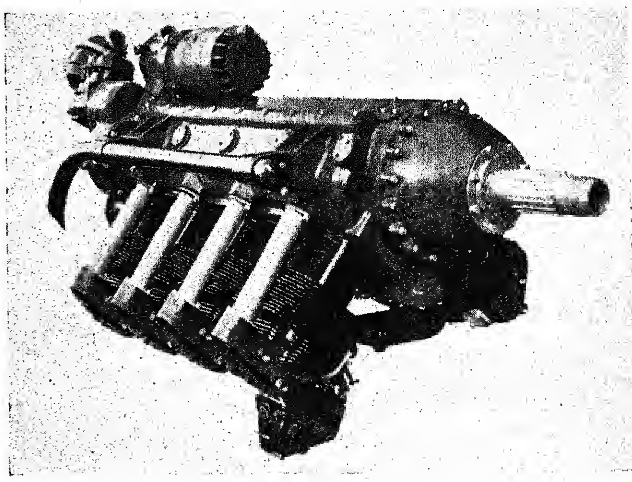
Type.—Seven-cylinder radial air-cooled, direct-drive (G.7) or geared (G.7R).
Cylinders.—Bore 96 m/m. (3.78 in.), Stroke 100 m/m. (3.94 in.), Capacity 5.27 litres (322 cub. in.), Compression ratio 7.1 : 1.
Accessories.—Zenith carburettor, AM. CM.12 fuel pump, B.G. magneto and dual ignition.
Airscrew Drive (G.7R) Epicyclic reduction gear 0.6 : 1 ratio.
Dimensions.—Diameter 815 m/m. (32 in.), Length 834 m./m (32.8 in.).
Weight Dry (G.7).—140 kg. (308 lbs.).
Weight Dry (G.7R).—148 kg. (325.6 lbs.).
Performance (G.7).—Maximum output 135 h.p. at 2,550 r.p.m., Normal rated output 122 h.p. at 2,500 r.p.m., Cruising output 78 h.p. at 2,200 r.p.m., Consumptions same as for G.4.
Performance (G.7R).—Maximum output 175 h.p. at 3,500 r.p.m., Normal rated output 148 h.p. at 3,150 r.p.m., Cruising output 115 h.p. at 2,900 r.p.m., Consumptions same as for G.4R.

THE MATHIS G.8 AND G.8R.

Type.—Eight-cylinder inverted Vee air-cooled, direct-drive (G.8) or geared (G.8R).
Cylinders.—Bore 96 m/m. (3.78 in.), Stroke 100 m/m. (3.94 in.), Capacity 6.024 litres (368 cub. in.), Compression ratio 7.1 : 1.
Accessories.—Zenith carburettor A.M. C.M.12 fuel-pump, B.G dual magneto.
Airscrew Drive (G.8R).—Epicyclic reduction gear 0.607 : 1 ratio.
Dimensions.—Length 834 m/m. (32.8 in.), Height 450 m/m. (17.7 in.), Width 700 m/m. (27.3 in.).
Weight Dry (G.8).—163 kg. (358.6 lbs.).
Weight Dry (G.8R).—170 kg. (374 lbs.).
Performance (G.8).—Maximum output 150 h.p. at 2,550 r.p.m., Normal rated output 140 h.p. at 2,500 r.p.m., Cruising output 90 h.p. at 2,200 r.p.m., Consumptions as for G.4.
Performance (G.8R).—Maximum output 210 h.p. at 3,500 r.p.m., Normal rated output 180 h.p. at 3,225 r.p.m., Cruising output 125 h.p. at 2,900 r.p.m., Consumptions as for G.4R.

THE MATHIS G.14R AND G.14RS.

Type.—Fourteen-cylinder two-row radial air-cooled geared (G.14R) and geared and supercharged (G.14RS).
Cylinders.—Bore 96 m/m. (3.78 in.), Stroke 100 m/m. (3.94 in.) Capacity 10.54 litres (644 cub. in.), Compression ratio 7.1 : 1 (G.14R) 6.2 : 1 (G.14RS).
Accessories.—Zenith carburettor, AM. CM.13 fuel pump, dual ignition.
Airscrew Drive.—Epicyclic reduction gear 0.6 : 1 ratio.
Supercharger (G.14RS) Centrifugal compressor driven at 8.2 : 1 crankshaft speed.
Dimensions.—Diameter 815 m/m. (32 in.), Length 1,097 m/m. (43.2 in.).
Weight Dry (G.14R) 275 kg. (605 lbs.).
Weight Dry (G.14RS) 290 kg. (638 lbs.).
Performance (G.14R).—Maximum output 350 h.p. at 3,500 r.p.m., Normal rated output 335 h.p. at 3,450 r.p.m., Cruising output 225 h.p. at 3,000 r.p.m., Consumptions as for G.7R.
Performance (G.14RS).—Maximum output 500 h.p. at 3,500 r.p.m., Normal rated output 426 h.p. at 3,450 r.p.m. at 2,000 m. (6,560 ft.), Cruising output 275 h.p. at 3,000 r.p.m. at 2,000 m. (6,560 ft.), Fuel consumption 245 gr. (.540 lbs.) per h.p./hr., Oil consumption 5gr. (.011 lbs.) per h.p./hr.



The 210 h.p. Mathis G.8 eight-cylinder engine.

MINIÉ.

VICTOR MINIÉ AÉRONAUTIQUE.

Head Office and Works: 53, Rue Edouard-Vaillant, Colombes (Seine).

This company, which specialises in the casting of light alloys, began the development of light aero-engines before the War. A feature of the three engines in production before the war, all four-cylinder horizontally-opposed, was that the cylinders and heads were cast in pairs. Only one engine of the post-war series retains this feature.

The present series of engines includes the Horus 4.D4, rated at 70 h.p. at 2,450 r.p.m., the 4.DA.25, rated at 60 h.p. at 2,450 r.p.m., and the 4.DA.28, rated at 70 h.p. at 2,430 r.p.m. The 4.D4 is the model which has its cylinders cast in pairs. The other two engines have conventional separate cylinders and heads.

THE HORUS 4.DA.28.

Type.—Four-cylinder horizontally-opposed air-cooled.
Cylinders.—Bore 100 m/m. (3.94 in.), Stroke 91.5 m/m. (3.6 in.), Capacity 2,874 litres (175.5 cub. in.), Compression ratio 7 : 1. Nickel-chrome steel barrels and light alloy heads shrunk on.
Pistons.—Light alloy castings. Three compression and one scraper rings.
Connecting Rods.—Forgings of nickel-chrome steel. Bronze small-ends. Roller-bearings at big-ends.
Crankshaft.—Special chrome-nickel steel forging running on two roller and one deep-groove ball thrust bearing.
Crankcase.—Of light alloy, in four parts. Upper and lower sections together form the main barrel which carries the four cylinders and the three crankshaft bearings. The lower section also encloses the camshafts. The rear section closes the barrel and carries the drives for the magneto, fuel pump, etc. An oil sump, may be mounted below the lower section.

MINIÉ—*continued.*

VALVE GEAR.—One inlet and one exhaust valve per cylinder. Carbon steel camshafts in lower section of crankcase operate valves through push-rods, rocker-arms and tappets. Double return springs. Totally enclosed valve-gear.
INDUCTION.—Two Zenith 34 EH carburetters, one for each pair of cylinders, on brackets above rear end of crankcase. Single induction pipe branches at inlet valves.
IGNITION.—One R.B. Type J4 double magneto mounted on upper section of crankcase. Two plugs per cylinder.
FUEL GRADE.—80 Octane.
LUBRICATION.—Either dry or wet sump. In either case circulation of oil ensured by either single or double gear pump.
STARTER.—Air-Equipement Type 44 hand-starter.
MOUNTING.—Either by four supports on rear section of crankcase for cantilever mounting, or four on lower half of crankcase for normal bearer mounting.
DIMENSIONS.—Length overall, including airscrew shaft 660 m/m. (25.9 in.), Overall height, including oil sump 515 m/m. (20.2 in.), Overall height, without oil sump 480 m/m. (18.8 in.), Overall width 830 m/m. (32.6 in.).
WEIGHT DRY.—84 kg. (184.8 lbs.).
PERFORMANCE.—Take-off output 73 h.p. at 2,450 r.p.m., Normal output 70 h.p. 2,430 r.p.m.

THE HORUS 4.DA.25.

The Horus 4.DA.25 is generally similar to the 4.DA.28 previously described. It may be provided with either one or two carburetters. This model is rated at 60 h.p. at 2,450 r.p.m.

THE HORUS 4.D4.

The Horus 4.D4 has its four opposed cylinders cast in pairs, as are also the cylinder heads. The cylinders are of cylindrically-cast iron and the heads are of light alloy, the whole assembly being secured to the crankcase by long through bolts. The side valves are below the cylinders, and the sparking-plugs, two per cylinder, are located in the heads.

The single Zenith carburetter is mounted below the crankcase and feeds through passages in the sump and *via* two short induction pipes to inlets between the cylinder barrels.

The Horus 4.D4 is rated at 70 h.p. at 2,450 r.p.m.

POTEZ.

MOTEURS POTEZ.

HEAD OFFICE : 10, RUE FRÉDERIC BASTIAT, PARIS (VIIIE).

The former Société des Aéroplanes Henry Potez began to build aero-engines in 1929. When the aircraft industry was nationalised in 1936 the aircraft works of the Potez company were absorbed into the S.N.C.A. du Nord and S.N.C.A. Sud-Est. The aero-engine branch, however, retained its independence, and development has continued without interruption since before the war.

The present series of engines of four, eight and twelve cylinders are the outcome of a programme introduced in 1935, and all are based on an original single cylinder research engine with a bore and stroke of 125 m/m. × 120 m/m. (4.92 in. × 4.72 in.). All have been officially type-tested and are in production.

During the period of occupation after 1940 the Potez experimental department devoted attention to the development of two seven-bank 28-cylinder units of 1,800 and 4,000 h.p. respectively.

THE POTEZ 4D. 01.

TYPE.—Four-cylinder inverted in-line air-cooled.
CYLINDERS.—Bore 125 m/m. (4.92 in.), Stroke 120 m/m. (4.72 in.), Capacity 5.85 litres (352 cub. in.), Compression ratio 7 : 1.
DIMENSIONS.—Length overall, including airscrew shaft 1,247 m. (49.1 in.), Overall height 0.660 m. (25.9 in.), Overall width 0.503 m. (19.8 in.).
WEIGHT DRY.—139 kg. (305.8 lbs.).
PERFORMANCE.—Take-off output 160 h.p. at 2,520 r.p.m., Maximum cruising output 124 h.p. at 2,320 r.p.m.

THE POTEZ 4D. 31.

This is the 4D. 01 fitted with a centrifugal supercharger mounted horizontally on the crankcase top cover. The dimensions are the same except that the overall height is now 0.692 m. (27.2 in.). It has a maximum output of 220 h.p.

THE POTEZ 8D. 10.

TYPE.—Eight-cylinder inverted 90° vee air-cooled.
CYLINDERS.—Same bore and stroke as 4D. 01. Capacity 11.7 litres (705 cub. in.), Compression ratio 7 : 1.
DIMENSIONS.—Overall length 1.275 m. (51.4 in.), Overall height 0.662 m. (26 in.), Overall width 0.825 m. (32.4 in.).
WEIGHT DRY.—245 kg. (539 lbs.).
PERFORMANCE.—Take-off output 320 h.p. at 2,500 r.p.m., Rated output 300 h.p. at 2,450 r.p.m.

THE POTEZ 8D. 20.

The 8D. 20 is a geared version of the D. 10 previously-described. In this model the overall length is increased to 1,475 m. (58 in.).

The engine has a take-off rating of 355 h.p. and a rated output of 335 h.p.

THE POTEZ 8D. 00.

The 8D. 00 is a geared and supercharged version of the basic D. 10.
REDUCTION GEAR.—Planetary type. Ratio 0.69 : 1.
SUPERCHARGER.—Centrifugal type.
WEIGHT DRY—309 kg. (680 lbs.).
PERFORMANCE.—Take-off output : 425 h.p. at 2,800 r.p.m. Normal rated output ; 370 h.p. at 2,600 r.p.m.

THE POTEZ 12D. 03.

TYPE.—Twelve-cylinder horizontally-opposed air-cooled, geared and supercharged.
CYLINDERS.—Same bore and stroke as for 4D. 01. Capacity 17.6 litres (1,072 cub. in.), Compression ratio 7 : 1.
REDUCTION GEAR.—Spur-gear type. Ratio 23 : 30.
SUPERCHARGER.—Centrifugal type, mounted horizontally beneath crankcase.
DIMENSIONS.—Length overall 1.702 m. (66.9 in.), Overall height 0.830 m. (32.6 in.), Overall width 0.945 m. (37.2 in.).
WEIGHT DRY.—398 kg. (875.6 lbs.).
PERFORMANCE.—Take-off output 575 h.p. at 2,500 r.p.m., Maximum output at 1,600 m. (5,250 ft.) 612 h.p. at 2,500 r.p.m., Maximum output at 3,500 m. (11,480 ft.) 480 h.p. at 2,500 r.p.m.

RÉGNIER.

SOCIÉTÉ ANONYME DES ETABLISSEMENTS EMILE RÉGNIER.

HEAD OFFICE AND WORKS : 77, RUE ALBERT SARRAUT, VERSAILLES (SEINE-ET-OISE).

The Société Anonyme des Etablissements Emile Régnier was established soon after the war of 1914-18 by M. Emile Régnier, a fighter pilot with many victories in the air.

In 1931 the Company acquired the licence to build the D.H. Gipsy III and Gipsy-Major engines and at the same time it began the development of its own engines, which made use of parts and components of D.H. conception.

For the Coupe Deutsch de la Meurthe, which was restricted to engines of 8 litres (488 cub. in.) capacity, Régnier designed a six-cylinder inverted engine which developed 194 h.p. A last-minute mishap to the Caudron 360 in which it was fitted, prevented the engine from taking part in the contest. In January, 1934, the Caudron 360 established an international speed record over 1,000 km. (621 miles) at 356 km.h. (222.4 m.p.h.).

In the 1934 Coupe Deutsch, the Régnier engine gained second place and in the following year it won the Grand Prix de l'Aero Club and was classed second in the Coupe Hélène Boucher. In 1936 the engine was fitted with a Roots blower but tests were not completed in time to allow it to compete in the Coupe Deutsch contest.

In the meantime Régnier designed and built a 60 h.p. two-cylinder engine which was fitted in the Volland V.10, and for the Service Technique de l'Aéronautique developed a 450 h.p. twelve-cylinder inverted vee geared engine with a cannon firing through the airscrew hub.

In 1936 four-cylinder engines of 70 h.p. and 100 h.p. respectively appeared. A licence for the smaller engine was sold in the United States. In 1939 the larger engine, fitted in a Mauboussin M.200 monoplane, put up international speed records over 100 and 1,000 km. (62.1 and 621 miles).

The French Air Ministry bought many different types of Régnier engines, the 180 h.p. 6B in 1935 and 1937 ; the 74 h.p. 4D2 and 98 h.p. 4E0 in 1938 ; and four engines for the Coupe Deutsch contest in 1939. These last-mentioned engines were twelve-cylinder units of 6½ litres (397 cub. in.) capacity and were specially developed for the contest. Fitted with Roots blowers they had a maximum output of 400 h.p. at 4,000 r.p.m.

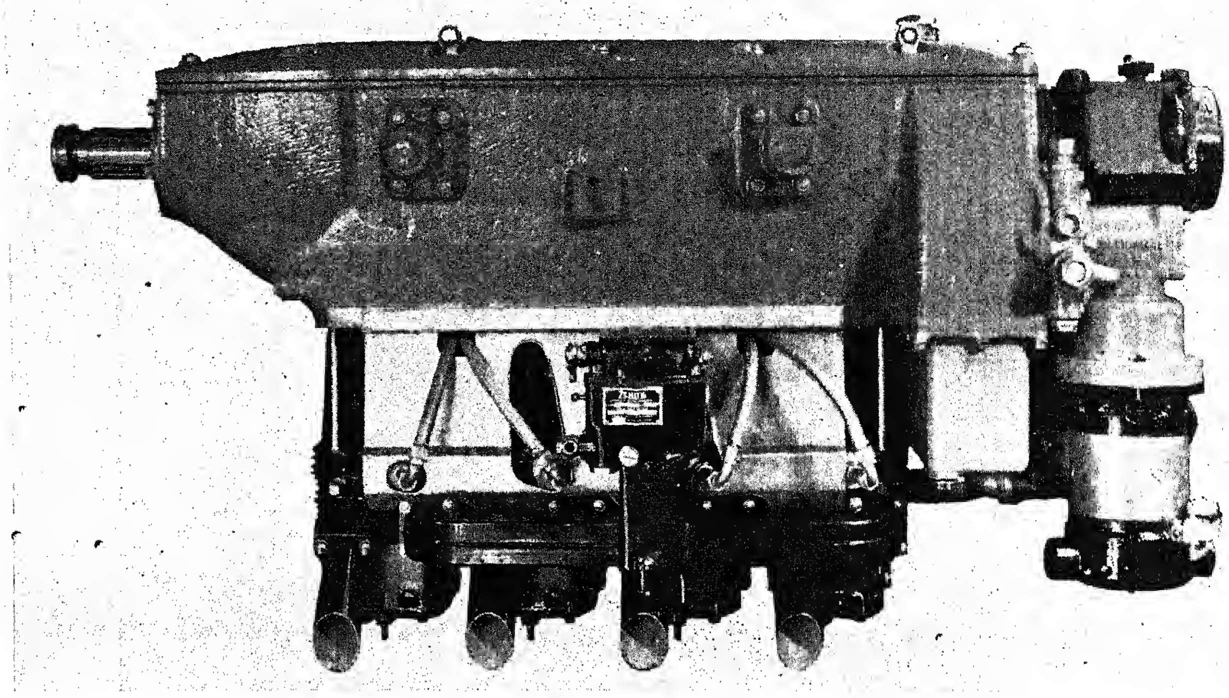
During the occupation of France the activities of the company were seriously hampered and it was not until 1943 that clandestine work on aero-engines was resumed. Studies were initiated with a view to simplification of design and production and a new series of four-cylinder inverted air-cooled engines was designed in which, apart from employing a wide interchangeability of accessories and parts, methods of manufacture and assembly were greatly simplified.

Since the liberation the new Régnier engines have been thoroughly tested and approved by the Service Technique de l'Aéronautique and put into series production by the Société Nationale de Constructions et d'Etudes Aéronautiques.

THE RÉGNIER 4JO, 4KO AND 4LO.

TYPE.—Four-cylinder in-line inverted air-cooled.
CYLINDERS.—Steel barrels machined all over and treated externally with a baked-on varnish to prevent corrosion. Separate Y-alloy heads held on barrels by four long bolts screwed into crankcase with a Metalloplastic joint between head and barrel and a dermatine sealing ring between barrel and crankcase. Valve seats and sparking-plug bushes of bronze-aluminium screwed into head. Rocker boxes integral with heads have Elektron covers held in place by quick-release cables.
VALVE GEAR.—One inlet and one exhaust underhead valve per cylinder, each with two springs. Valves operated from camshaft through push-rods and adjustable tappets. Engine valve-gear enclosed.
CRANKSHAFT.—Four-throw steel forging on five bearings.
CONNECTING RODS.—I-section duralumin forgings with split steel-backed bronze bearings.
CRANKCASE.—Magnesium casting carrying the main crankshaft bearings which are held in position by separate caps. All oilways cast internally. All accessory drives and oil pumps enclosed in rear portion of case. Magnesium cover provided with breather and lifting rings.

RÉGNIER—*continued.*



The 100 h.p. Regnier 4KO four-cylinder in-line inverted air-cooled engine.

IGNITION.—Dual magneto on rear of main crankcase fires two plugs per cylinder.
CARBURATION.—Zenith carburettor on port side of engine. Welded sheet steel manifold with heater muff.
LUBRICATION.—Pressure lubrication. Engine-driven gear type pump. All oilways in crankcase casting or drilled in crankshaft webs. Two scavenge pumps, one forward and one aft. Provision for scavenging from crankcase cover when engine inverted.
DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

RÉGNIER 4-CYLINDER INVERTED AIR-COOLED ENGIÑES.

Model	Bore and Stroke	Capacity	Compression Ratio	Rated output at sea level	Dry Weight	Dimensions		
						Length	Width	Height
4JO	92 m/m × 110 m/m. (3.62 in. × 4.33 in.)	2.925 litres (178.5 cu. in.)	6.08 : 1	74 h.p. at 2,350 r.p.m.	78 kg. (172 lbs.)	1,090 m/m. (42.9 in.)	416 m/m. (16.4 in.)	578.5 m/m. (23.2 in.)
4KO	105 m/m. × 115 m/m. (4.14 in. × 4.53 in.)	4 litres (244 cub. in.)	6.1 : 1	98 h.p. at 2,300 r.p.m.	90 kg. (198 lbs.)	1,155 m/m. (45.5 in.)	429 m/m. (16.9 in.)	606.5 m/m. (23.9 in.)
4LO	120 m/m. × 140 m/m. (4.72 in. × 5.51 in.)	6.3 litres (384.4 cu. in.)	6.2 : 1	145 h.p. at 2,350 r.p.m.	135 kg. (297 lbs.)	1,360 m/m. (53.5 in.)	485 m/m. (19.1 in.)	688 m/m. (27.3 in.)

RENAULT (SEE S.N.E.C.M.A.)

S.C.E.M.M.

SOCIÉTÉ DE CONSTRUCTION ET D'EXPLOITATION DE MATÉRIELS ET DE MOTEURS (S.C.E.M.M.).

HEAD OFFICE: 14, RUE DE LUBECK, PARIS (XVIE).
WORKS: USINE DU ROND-POINT, SAINT-ETIENNE (LOIRE).
PROTOTYPE FACTORY: 14, RUE BASLY, ASNIÈRES (SEINE).

The Société de Construction et d'Exploitation de Matérials et de Moteurs was established in 1938 to manufacture the Béarn six-cylinder in-line inverted air-cooled engine, which is claimed to be the highest-powered engine of its type in the World. With supercharger the Béarn 6D develops 390 h.p. for take-off and 350 h.p. at 2,700 r.p.m. at 2,300 m. (7,545 ft.). The Béarn 6D has been fitted to a number of French aircraft, including the SO-90 twin-engined civil monoplane, the SCAN-20 single-engined flying-boat, the Bloch MB-30 military advanced trainer, and the SE-700 Autogiro.

THE BÉARN 6D.

TYPE.—Six-cylinder in-line inverted air-cooled, geared and supercharged.
CYLINDERS.—Bore 130 m/m. (5.125 in.), Stroke 135 m/m. (5.32 in.), Capacity 10.75 litres (655 cub. in.), Compression ratio 6.8 : 1. Steel cylinder barrels. Light alloy heads screwed and shrunk on to barrels. Two inclined valves per cylinder, the cooling fins of the head being cast obliquely parallel to the centre-lines of the valves.
VALVE GEAR.—One inlet and one exhaust valve per cylinder. Two camshafts in sides of crankcase operate valves through push-rods, rocker-arms and tappets. Entire valve-gear enclosed and pressure-lubricated.
CARBURATION.—Zenith carburetter with automatic mixture control and altitude correction.
SUPERCHARGER.—Centrifugal compressor driven off rear end of crankshaft. Ratio 11.15 : 1. Diameter of rotor 167 m/m. (6.6 in.).
IGNITION.—Two R.B. type P6 BA magnetos with automatic advance. Two B.G. type 122 sparking-plugs per cylinder.
REDUCTION GEAR.—Planetary type. Ratio 2 : 3.
STARTER.—Hand/electric A.E. inertia starter.
FUEL GRADE.—87 or 100 Octane.
DIMENSIONS.—Overall length 1.780 m. (70 in.), Overall height 0.872 m. (34.3 in.), Overall width 0.50 m. (19.7 in.).
WEIGHT DRY.—315 kg. (693 lbs.).
PERFORMANCE.—Take-off power (2 min.) 390 h.p. at 2,800 r.p.m. (100 Octane) from sea level to 800 m. (2,440 ft.), Normal output at sea level 325 h.p. at 2,700 r.p.m., Normal output at altitude 350 h.p. at 2,700 r.p.m. at 2,300 m. (7,545 ft.), Cruising output 230 h.p. at 2,400 r.p.m.

S.N.E.C.M.A.

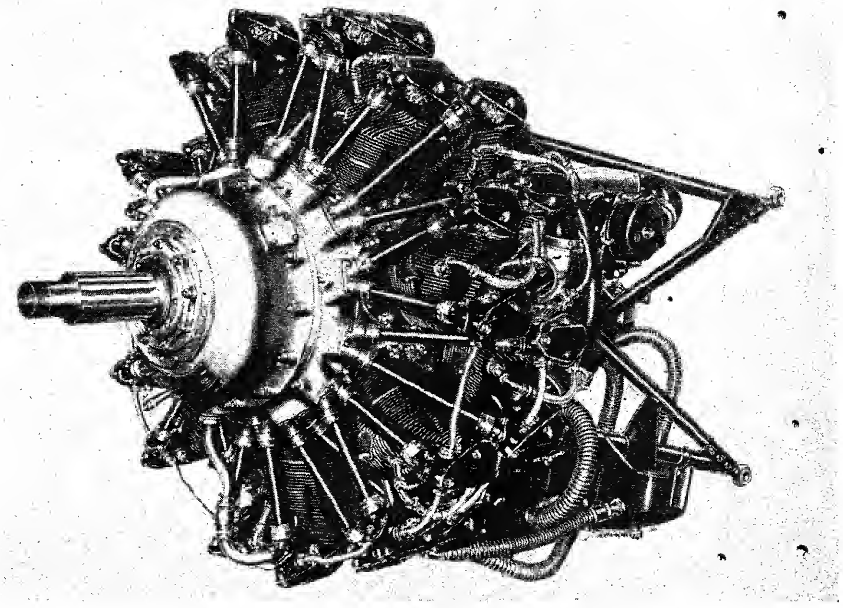
SOCIÉTÉ NATIONALE D'ETUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION.

HEAD OFFICE: 150, Boulevard Haussmann, Paris 8e.
WORKS: PARIS (BOULEVARD KELLERMANN), ARGENTEUIL (SEINE-ET-OISE), BILLANCOURT (SEINE), ARNAGE (SARTHE) AND GENNEVILLIERS (SEINE).
President-Director General: Marcel Weill.
Secretary General: Robert Collas.
Production Director: Gaston Leny.
Technical Director: Raymond Marchal.

The Société Nationale d'Etude et de Construction de Moteurs d'Aviation is the successor to the Société des Moteurs Gnôme-et-Rhône which was nationalised in 1945. The S.N.E.C.M.A. continues the manufacture of the Gnôme-Rhône 14M, 14N and 14R radial air-cooled engines, and is also building the Renault 4P and 6Q in-line inverted air-cooled engines. New types are under development. A special department is also engaged in the study of gas-turbine engines.

***S.N.E.C.M.A.**—continued.*

The names Gnôme and Le Rhône belong to the historic period and rotary engines of both names played a notable part in the early history of aviation and in the First World War. During the war 1914-18, the two names were merged into one organization and in 1922 the Gnôme-Rhône company undertook the construction of radial air-cooled engines, beginning with the Bristol Jupiter built under licence. Then followed the Gnôme-Rhône 7K, 9K, 14K, 14M and 14N. In 1939 the Société des Moteurs Gnôme-et-Rhône was producing the 14M and 14N in quantity and was beginning the production of the 14R.



The 650-720 h.p. Gnôme-Rhône 14M engine.

THE GNÔME-RHÔNE 14M SERIES.

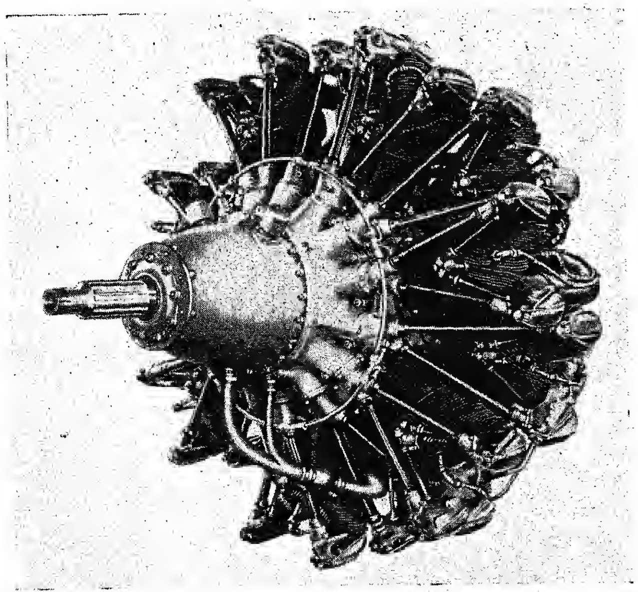
Type.—Fourteen-cylinder two-row radial air-cooled, geared and supercharged.

Cylinders.—Bore 122 m/m. (4.8 in.), Stroke 116 m/m. (4.56 in.), Capacity 18.9 litres (1,175 cub. in.), Compression ratio 6.4 : 1. Nitrided steel barrels with screwed and shrunk-on aluminium-alloy heads. Barrels attached to crankcase by eight studs each. Two inclined valves per cylinder.

Pistons.—Forged duralumin, with two compression and two scraper rings. Fully-floating gudgeon-pins.

Connecting Rods.—Two identical sets of rods, one for each bank of cylinders, each consisting of a single-piece master-rod and six auxiliary-rods, all I-section nickel-chrome steel. Steel-backed white metal master-rod bearing. Auxiliary rods are bronze-bushed for both piston and knuckle-pin.

Crankshaft.—Two-throw nickel-chrome steel shaft in three pieces.



The 990-1,150 h.p. Gnôme-Rhône 14N engine.

Crankcase.—Forged duralumin case in three pieces, the centre portion carrying the fourteen cylinders, the front portion housing the valve timing gear and supporting the reduction gear case, and the rear portion housing the supercharger and the rear cover which carries the accessories and their drives.

Valve Gear.—Two inclined valves per cylinder. Double cam-ring in front portion of crankcase operates valves through push-rods and rocker-arms. Valve-gear and push-rods enclosed in oil-tight casings.

Carburation.—Bronzavia type 110 L2 carburettor with automatic altitude correction, automatic and manual override enrichment control, starter and choke. Mixture fed to single-stage centrifugal compressor and thence through tubular aluminium manifolds to cylinders. Compressor drive taken off rear end of crankshaft through planetary gearing. Supercharger gear ratio 8.24 : 1. Two independent AM type 13CM fuel pumps.

Ignition.—Two RB type P14 B.E.A. magnetos with automatic advance. Two BG type 4RT6 plugs per cylinder. Fully screened ignition system.

Lubrication.—Pressure lubrication with one pressure and two scavenge pumps.

Reduction Gear.—Gnôme-Rhône epicyclic gear with straight satellite pinions. Ratio 12/17.

Airscrew Rotation.—14M4 anti-clockwise; 14M5 clockwise.

Starting.—Air-Equipement type 47 hand/electric inertia starter.

Accessories.—All auxiliaries, including generator, hydraulic pump, vacuum pump, air compressor, tachometer drive and gun interrupter-gear drive mounted on rear cover. Drives taken off extension of crankshaft which drives the compressor.

Dimensions.—Overall diameter 950 m/m. (37.4 in.).

Performance.—Take-off output 720 h.p. at 3,030 r.p.m. at 6½ lbs. (1,100 m/m. Hg.) boost, Normal rated output 650 h.p. at 2,800 r.p.m. at 4,000 m. (13,125 ft.), Normal rated output at sea level 570 h.p. at 2,800 r.p.m., Maximum permissible r.p.m. 3,300.

THE GNÔME-RHÔNE 14N SERIES.

The 14N Series of engines is generally similar to the previously described 14M Series but is of larger dimensions and greater horsepower.

Type.—Fourteen-cylinder two-row radial air-cooled, geared and supercharged.

Cylinders.—Bore 146 m/m. (5.74 in.), Stroke 165 m/m. (6.5 in.), Capacity 38.67 litres (2,358 cub. in.), Compression ratio 6.8 : 1.

Carburation.—Zenith type 125 R.G.S.L.A. 11 with automatic altitude correction, automatic or manual override enrichment control starter and choke. One AM type 15CM fuel pump.

Supercharger.—Single-stage centrifugal blower. Ratio 6.4 : 1.

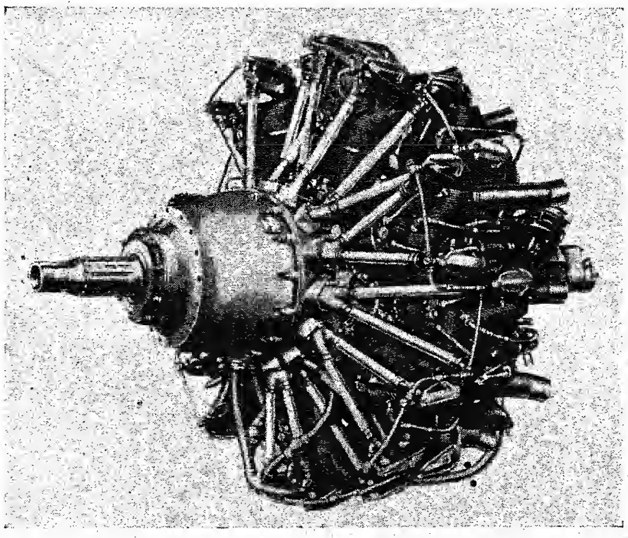
Ignition.—Two B.G. type 14C shielded magnetos with automatic advance. Two plugs per cylinder. Entire ignition system fully shielded.

Reduction Gear.—Gnôme-Rhône epicyclic gear with conical satellites. Gear ratio 2/3.

Airscrew Rotation.—14N54 and 14N56 anti-clockwise; 14N55 and 14N57 clockwise.

Dimensions.—Overall diameter 1,290 m/m. (50.7 in.), Length (over starter) 1,725 m/m. (67.8 in.).

Weight (with ignition, fuel pump, carburettor and starter, but without deflectors and baffles, exhaust pipes and auxiliaries).—667 kg. (1,467.4 lbs.).



The 1,600 h.p. Gnôme-Rhône 14R engine.

S.N.E.C.M.A.—*continued.*

Performance.—Take-off output 1,150 h.p. at 2,400 r.p.m. at 2½ lb. (890 m/m. Hg.) boost. Normal rated output 990 h.p. at 2,400 r.p.m. at 2,900 m. (9,510 ft.), Normal rated output at sea level 900 h.p. at 2,400 r.p.m., Maximum permissible r.p.m. 2,600.

THE GNÔME-RHÔNE 14R SERIES.

The 14R Series is similar to the 14N except that engines in this series are fitted with two-speed superchargers and all auxiliaries are mounted on a separate remotely-driven gear-box.

Type.—Fourteen-cylinder two-row radial air-cooled, geared and supercharged.

Cylinders.—Dimensions as 14N Series. Compression ratio 6.43 : 1.

Carburation.—Bronzavia type 160 L2 carburettor. One AM 26SP fuel pump.

Supercharger.—Single-stage two-speed centrifugal supercharger. Ratios 6.5 and 9.01 : 1.

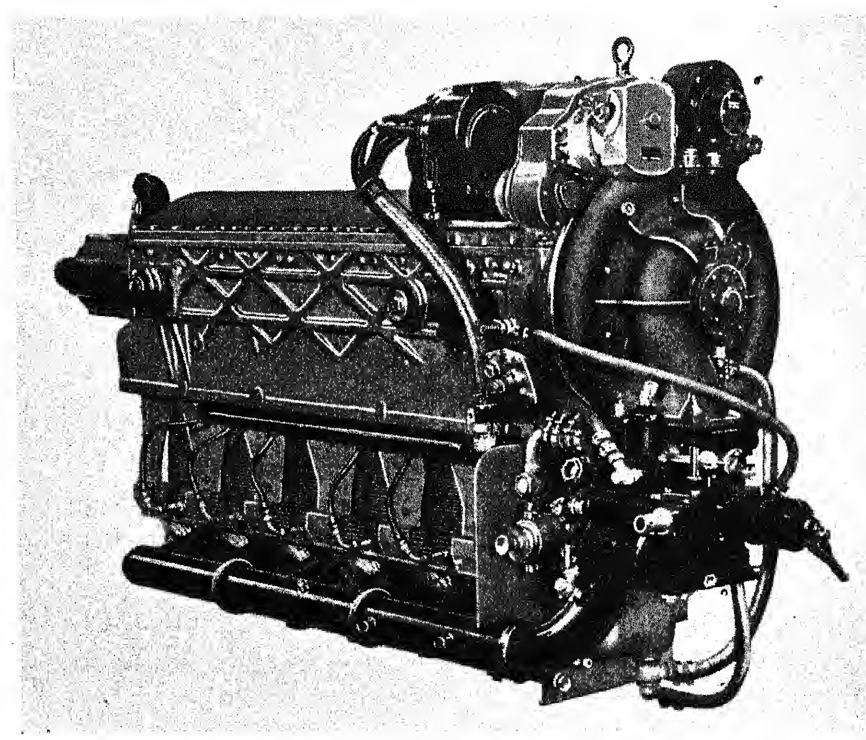
Reduction Gear.—Gnôme-Rhône epicyclic gear with conical satellite pinions. Ratios 9/16 (14R24/25 and 14R28/19), 13/29 (14R 26/27).

Airscrew Rotation.—14R engines with odd qualifying numbers clockwise, even numbers anti-clockwise.

Dimensions.—Overall diameter 1,298 m/m. (51 in.), Length (less airscrew shaft) 1,635 m/m. (64.32 in.).

Weight Dry.—819 kg. (1,802 lbs.).

Performance.—Take-off output 1,600 h.p. at 2,600 r.p.m. at 8½ lbs. (1,200 m/m. Hg.) boost, Normal rated output 1,325 h.p. at 2,400 r.p.m. at 2,500 m. (8,200 ft.) in M.S. gear and 1,225 h.p. at 2,400 r.p.m. at 6,700 m. (21,980 ft.) in H.S. gear, Maximum output 1,650 h.p. at 2,600 r.p.m. at 800. m. (2,625 ft.) in M.S. gear and 1,525 h.p. at 2,600 r.p.m. at 6,100 m. (20,000 ft.) in H.S. gear.



The 296 h.p. 6Q six-cylinder supercharged engine.

THE RENAULT 6Q.

Type.—Six-cylinder in-line inverted air-cooled.

Cylinders.—Bore 120 m/m. (4.72 in.), Stroke 140 m/m. (5.51 in.), Capacity 9.5 litres. Compression ratio 6.4 : 1. Steel barrels have machined cooling fins. Aluminium-alloy cylinder heads have cast fins. Inlet and exhaust ports on same side of head. Austenitic steel valve seats. Hemispherical combustion chamber. Heads held on barrels and barrels attached to crankcase, each by four long bolts screwed into latter. Rubber joint between cylinder and crankcase, metal gasket between head and barrel.

Pistons.—Aluminium-alloy forgings internally ribbed. Four rings. Fully-floating gudgeon-pin.

Connecting Rods.—I-section duralumin forgings. Split white metal big-end bearings, solid bronze-bushed little ends.

Crankshaft.—Six-throw steel forging machined all over. Journals and pins bored for lightness and lubrication. Runs in seven main bearings.

Crankcase.—Aluminium-alloy main case and magnesium cover. Main case has internal and external ribbing and five cross members which, together with the front and rear walls, carry the seven shaft bearings. Ball thrust bearing located in extension of main case.

Valve Gear.—One inlet and one exhaust valve per cylinder. Valves separately operated through tappets, rockers and push-rods from camshaft in crankcase driven off rear end of crankshaft.

Carburation.—Two Zenith type 60 1BGS carburettors on starboard side of engine each supplying three cylinders. Small pipe between manifolds balances depression between each system. Two AM No. 0 fuel pumps.

Supercharger.—In supercharged version, the centrifugal blower is mounted at rear end of standard crankcase otherwise closed by a circular cover plate. Supercharger draws mixture through single carburettor and boost pressure control and supplies cylinders through manifold on port side of engine. Gear ratio 7.61 : 1.

Lubrication.—Dry sump system. Gear-type pump supplies oil under pressure to crankshaft, big-ends, camshaft, timing gears and accessory drives. Pistons and cylinders lubricated by splash. Double scavenge pump draws oil from front or rear of case according to altitude.

Ignition.—Two S.E.V. type 160/161 magnetos mounted on forward face of upward extension of top cover. Fully-screened ignition system. Two B.G.ART6 plugs per cylinder.

Starter.—Air-Equipement type Viet C-73 compressed-air starter.

Accessories.—Gear drives for most auxiliaries in rear portion of crankcase cover. On forward face of upward extension are the magnetos and generator. On rear face are the vacuum pump, tachometer drive, airscrew regulator, etc.

Airscrew Rotation.—6Q engines with odd qualifying numbers clockwise rotation. with even numbers anti-clockwise.

Dimensions (Unsupercharged model).—Length 1,600 m/m. (63 in.), Width 510 m/m. (20 in.), Height 920 m/m. (36 in.).

Dimensions (Supercharged model).—Length 1,842 m/m. (71.8 in.), Width 465 m/m. (18.3 in.), Height 920 m/m. (36 in.).

Dry Weight.—240 kg. (528 lbs.) unsupercharged, 253 kg. (556.6 lbs.) supercharged.

Performance (Unsupercharged model).—Take-off output 233 h.p. at 2,500 r.p.m., Normal rated output 218 h.p. at 2,500 r.p.m. at 500 m. (1,640 ft.).

Performance (Supercharged model).—Take-off output 296 h.p. at 2,500 r.p.m., Normal rated output 237 h.p. at 2,500 r.p.m. at 2,200 m (7,220 ft.).

THE RENAULT 4 P01.

Type.—Four-cylinder in-line inverted air-cooled.

Cylinders.—Bore 120 m/m. (4.72 in.), Stroke 140 m/m. (5.51 in.), Capacity 6.33 litres (372 cub. in.), Compression ratio 5.8 : 1. Same as for 6Q.

Pistons.—Same as for 6Q.

Connecting Rods.—Same as for 6Q.

Crankshaft.—Four-throw steel forging machined all over. Journals and pins bored for lightness and lubrication. Runs in five white metal bearings, with ball thrust bearing permitting use of tractor or pusher propeller.

Crankcase.—Aluminium-alloy main case and magnesium cover. Three transverse members and front and rear walls of main case carry the main crankshaft bearings. Small duralumin case on front of main case carries thrust bearing.

Carburation.—Zenith type NAR 60 1GS carburettor mounted on starboard side of crankcase fed by two AM No. 00 fuel pumps. Four branch manifold feeds cylinders.

Ignition.—Two S.E.V. type DA4 magnetos, the port magneto with impulse starter.

Lubrication.—Dry sump system as for 6Q.

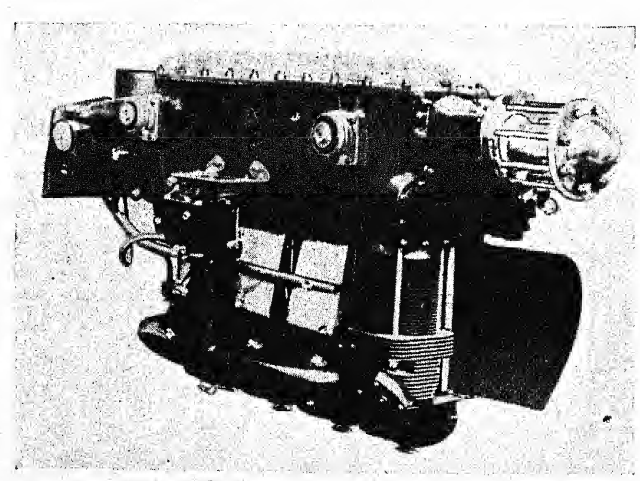
Starter.—Air-Equipement type Viet 63*bis* compressed-air starter

Airscrew Rotation.—Clockwise.

Dimensions.—Length 1,280 m/m. (50.4 in.), Width 480 m/m. (18.9 in.) Height 708 m/m. (27.8 in.).

Dry Weight.—147 kg. (323.4 lbs.).

Performance.—Normal output 140 h.p. at 2,400 r.p.m. at sea level.



The 140 h.p. Renault 4 P01 four-cylinder engine.

SALMSON.

SOCIÉTÉ DES MOTEURS SALMSON.

Head Office and Works: 102, Rue du Point-du-Jour, Boulogne-Billancourt (Seine).

This very old-established firm which produced its first aero-engines a year or two before the 1914-18 war, has revived several of its engines which were in production before the war 1939-45. These include the 45 h.p. 9ADB, the 83 h.p. 5AP.01, the 105 h.p. 5AP.03 and the 230 h.p. 9ABC, all air-cooled radials of conventional design.

THE SALMSON RADIAL AIR-COOLED ENGINES.

Type.—Five (5AP) or nine (9AB and 9AD) cylinder radial air-cooled.
Cylinders.—Cast steel barrels with Y-alloy heads screwed and shrunk on. Two inclined valves per cylinder.
Pistons.—Aluminium-alloy. Four rings, three compression and one scraper.
Connecting Rods.—Split master-rod and four or eight articulated rods.
Crankshaft.—Single-throw, statically and dynamically balanced. Two main roller bearings and one ball thrust bearing.
Crankcase.—Barrel type of aluminium-alloy. Main case split on centre-line of cylinders. Front cover encloses valve-gear mechanism, rear cover incorporates distribution passages and acts as mounting for accessories.
Valve Gear.—Two overhead valves per cylinder. Cam-ring driven by planetary gear at ⅛th engine speed in crankcase front cover. Valves operated by push-rods, tappets and rocker arms.
Ignition.—Salmson dual magnetos and two plugs per cylinder.
Carburation.—Zenith carburettor.
Lubrication.—Pressure.

THE SALMSON 9ADB.

Type.—Nine-cylinder radial air-cooled.
Cylinders.—Bore 70 m/m. (2.75 in.), Stroke 86 m/m. (3.38 in.), Compression ratio 5.6 : 1.
Dimensions.—Diameter 658 m/m. (25.9 in.), Length 694 m/m. (27.3 in.), Weight (with magnetos, carburetter but without exhaust pipes) 74 kg. (162 lbs.).
Performance.—Rated output 45 h.p. at 2,200 r.p.m., Maximum output 59 h.p. at 2,350 r.p.m.

THE SALMSON 5AP.01.

Type.—Five-cylinder radial air-cooled.
Cylinders.—Bore 100 m/m. (3.94 in.), Stroke 94 m/m. (3.7 in.), Compression ratio 6 : 1.
Weight (Without starter and exhaust pipes).—91 kg. (200 lbs.).
Performance.—Rated output 83 h.p. at 2,300 r.p.m.

THE SALMSON 5AP.03.

This engine is similar to the 5AP.01 except that it has an increased stroke and is fitted with a reduction gear.
Cylinders.—Bore 100 m/m. (3.94 in.), Stroke 100 m/m. (3.94 in.), Compression ratio 6 : 1.
Weight (Without starter and exhaust system).—110 kg. (242 lbs.).
Performance.—Rated output 105 h.p. at 3,100 r.p.m. crankshaft r.p.m.

THE SALMSON 9ABC.

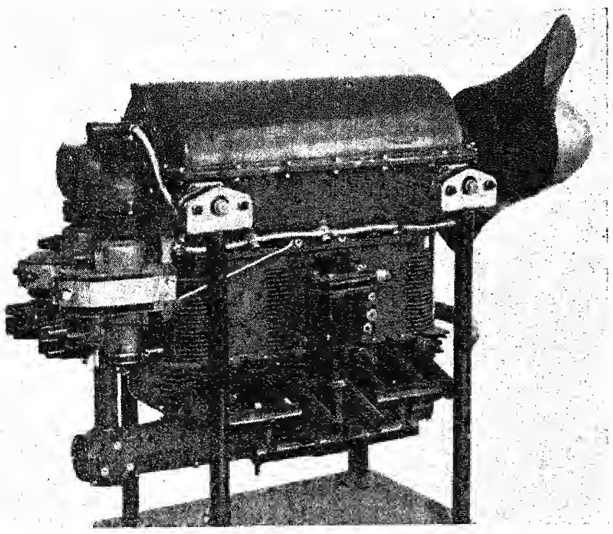
Type.—Nine-cylinder radial air-cooled.
Cylinders.—Bore 125 m/m. (4.94 in.), Stroke 170 m/m. (6.7 in.), Compression ratio 5.4 : 1.
Performance.—Rated output 230 h.p. at 1,700 r.p.m., Maximum output 260 h.p. at 1,780 r.p.m.

TRAIN.

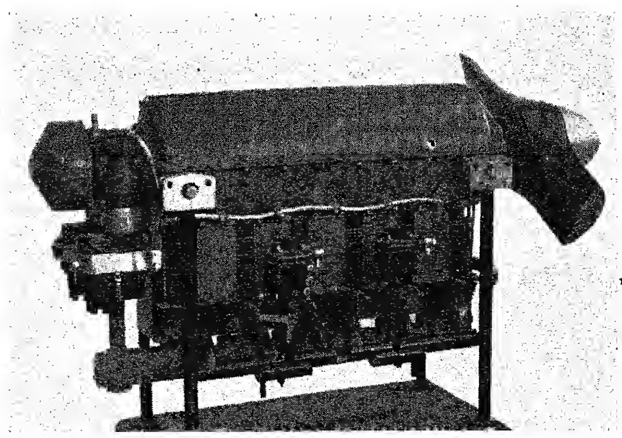
SOCIÉTÉ DES CONSTRUCTIONS GUINARD.

Head Office and Works: 9, Rue Rouget de l'Isle, Courbevoie (Seine).

The Société des Constructions Guinard has taken over production of the Train light aero-engines, which had been developed in France prior to the War by the Établissements E. Train.



The 50 h.p. Train four-cylinder engine.



The 75 h.p. Train six-cylinder engine.

This firm was founded in 1889, and was owned by one of the earliest pioneers of French aviation.

The earlier Train engines were described in the 1939 issue of "All the World's Aircraft." Present production is centred on the 50 h.p. four-cylinder and the 75 h.p. six-cylinder in-line inverted air-cooled engines. They are generally similar to the earlier types previously described.

THE TRAIN 4E.

The 4E is a four-cylinder inverted air-cooled engine with a capacity of 6.5 litres. It has an output of 50 h.p. at 2,400 r.p.m. and weighs 52 kg. (114.4 lbs.).

ITALY

ALFA.

SOCIETA ANONIMA ALFA ROMEO.

HEAD OFFICE AND WORKS: VIA M.U. TRAIANO 33, MILAN.

This important company, manufacturers of the well-known Alfa-Romeo automobile, entered the Italian aero-engine industry in 1925 with the acquisition of the Jupiter engine licence from the Bristol Aeroplane Co., Ltd., and the Lynx engine licence from Armstrong Siddeley Motors, Ltd. In 1930 the company produced its first engine of original design, the D2, and in the following year it acquired licences to build the Bristol Mercury and Pegasus engines.

With the experience gained in the development and production of the above-mentioned engines the Alfa company produced the 135 R.C.32 which, at that time was the most powerful aero-engine in the World.

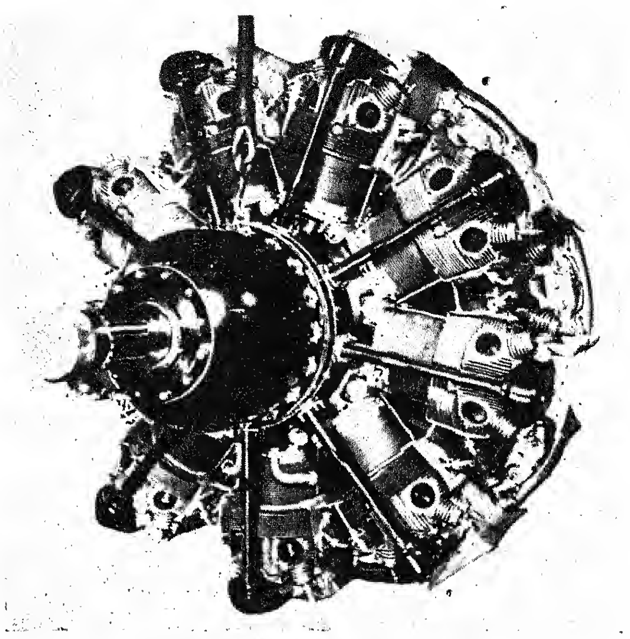
During the last war the company built the Alfa 121 R.C.14, an eight-cylinder inverted vee supercharged engine; the 131 R.C.14-50, a nine-cylinder radial with two-speed supercharger; the 138 R.C.23-65, eighteen-cylinder radial with two-speed blower; the 135 R.C.100 and the Alfa 101, a twenty-eight cylinder multi-row engine developing 2,000 h.p.

THE ALFA 131.

TYPE.—Nine-cylinder radial air-cooled geared and supercharged.
CYLINDERS.—Bore 146 m/m. (5.75 in.), Stroke 190 m/m. (7.48 in.), Capacity 28.63 litres, Compression ratio 6.3 : 1. Open-ended barrels machined from alloy-steel forgings. Internal surfaces nitrided. Heads machined from aluminium forgings.
PISTONS.—Forged from duralumin stampings. Three compression rings and one oil control ring above gudgeon-pin, one oil scraper ring below.
CONNECTING RODS.—Master and secondary rods machined from chrome-nickel steel forgings.
CRANKSHAFT.—Two-piece shaft in nitrated steel carried on two main roller bearings, a deep-groove ball-bearing at the front and a white-metal steadying bearing at rear.
CRANKCASE.—Machined from duralumin forgings, split on centre-line of cylinders.
REDUCTION GEAR.—Farman type. Ratio 0.655 : 1.
VALVE GEAR.—Four valves per cylinder. Nitrided valve-stems.
SUPERCHARGER.—Centrifugal type. Two speeds 6.91 and 9.93 : 1.
CARBURATION.—Mona-Hobson AVT 100 MB automatic carburetter.
IGNITION.—Two Marelli A.Q.9 magnetos.
LUBRICATION.—Pressure. Duplex gear pump.
DIMENSIONS.—Diameter overall 1.407 m. (55 in.), Length 1.446 m. (56.8 in.).
WEIGHT.—553 kg. (1,216.6 lbs.).
PERFORMANCE.—Take-off output 1,130 h.p. at 2,500 r.p.m., Normal output at 1,400 m. (4,590 ft.) in MS gear 930 h.p. at 2,300 r.p.m., Normal output at 5,000 m. (16,400 ft.) in FS gear 820 h.p. at 2,300 r.p.m., Maximum output at 900 m. (2,950 ft.) in MS gear 1,070 h.p. at 2,500 r.p.m., Maximum output at 5,000 m. (16,400 ft.) in FS gear 925 h.p. at 2,500 r.p.m.

THE ALFA 138.

TYPE.—Eighteen-cylinder two-row radial air-cooled, geared and supercharged.
CYLINDERS.—Bore 146 m/m. (5.75 in.), Stroke 160 m/m. (6.3 in.), Capacity 48.2 litres, Compression ratio 6.3 : 1. Barrels are steel forgings machined all over. Internal surfaces nitrided. Aluminium cylinder heads.
PISTONS.—Duralumin. Three compression rings and one oil control ring above the piston pin, one oil scraper ring below.
CONNECTING RODS.—Master and auxiliary rods are chrome-nickel steel stampings. Floating big-end bearings.
CRANKSHAFT.—Four-piece shaft supported on roller bearings.
REDUCTION GEAR.—Farman type. Ratio 0.5 : 1.
VALVE GEAR.—Four valves per cylinder. Nitrided valve stems. Stellited valve seats.
SUPERCHARGER.—Centrifugal type. Two speeds, 5.979 and 8.447 : 1.

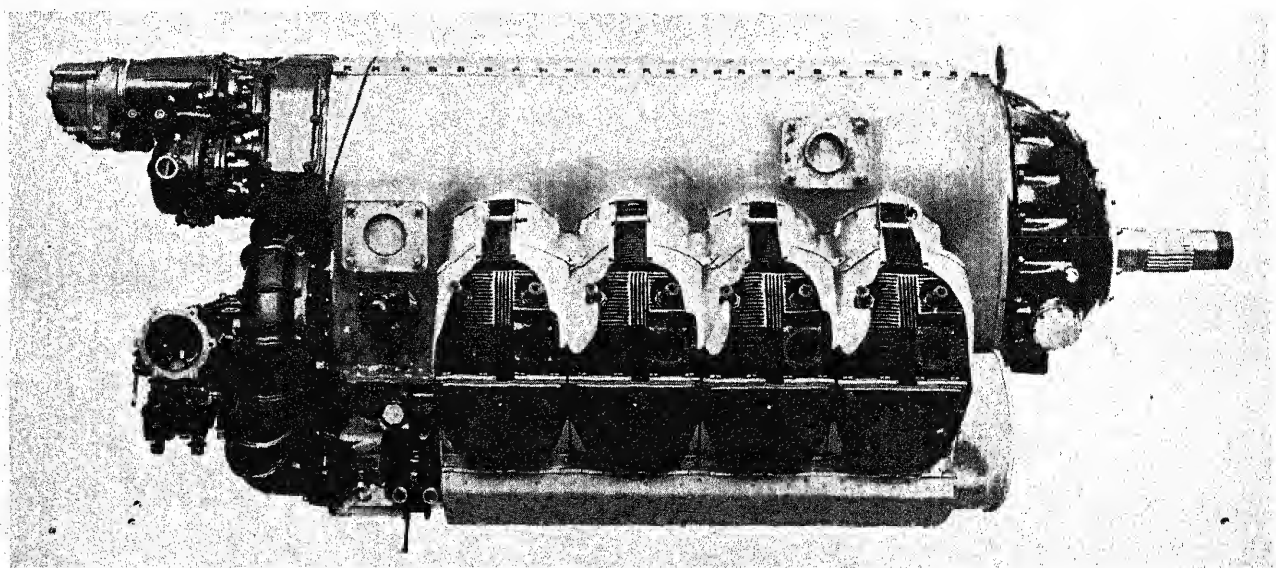


The 1850/1900 h.p. Alfa 138 radial air-cooled engine.

CARBURATION.—Mona SM 140 DI updraught carburetter.
IGNITION.—Two Marelli AQ 18S magnetos.
LUBRICATION.—Gear pump with filter incorporated.
DIMENSIONS.—Overall diameter 1.315 m. (51.75 in.), Overall length 2.198 m. (86.53 in.).
WEIGHT.—1,040 kg. (2,288 lbs.).
PERFORMANCE.—Take-off output 1,850/1,900 h.p. at 2,500 r.p.m. Maximum output in MS gear 1,550/1,580 h.p. at 2,500 r.p.m. at 2,300 m. (7,545 ft.), Maximum output in FS gear 1,400/1,500 h.p. at 2,500 r.p.m. at 6,500 m. (21,320 ft.).

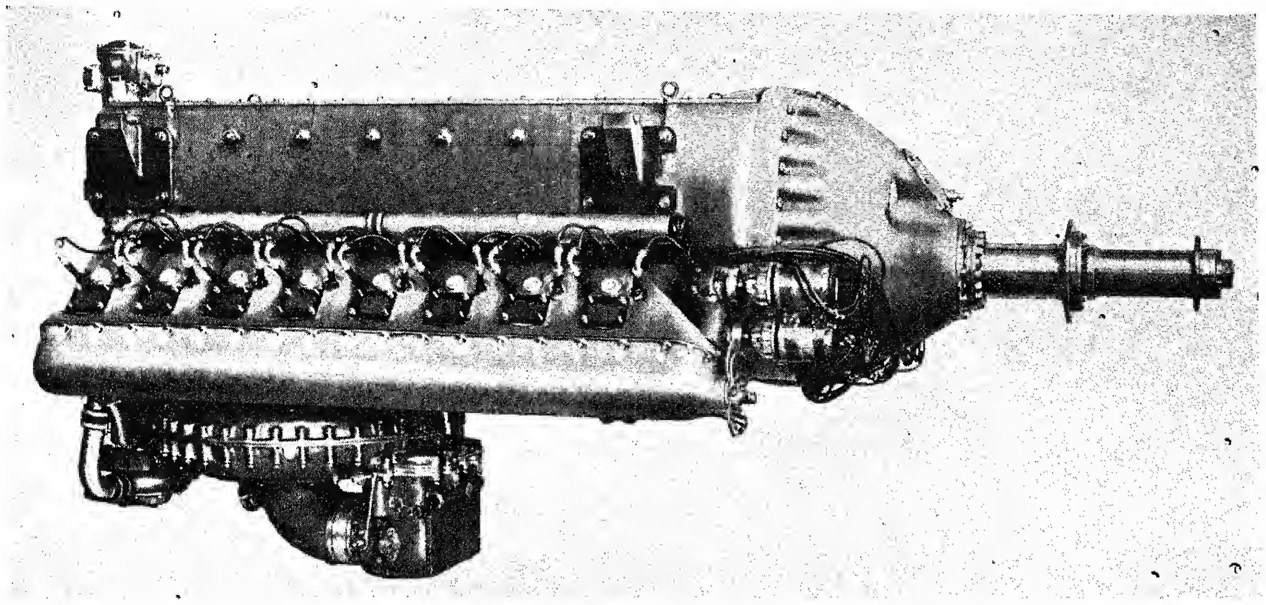
THE ALFA 121.

TYPE.—Eight-cylinder inverted vee air-cooled, geared and supercharged.
CYLINDERS.—Bore 120 m/m. (4.72 in.), Stroke 110 m/m. (4.375 in.), Capacity 9.952 litres, Compression ratio 6.5 : 1. Nitrided steel barrels machined all over. Aluminium-alloy cylinder heads.
PISTONS.—Duralumin forgings. Three compression rings and one scraper ring above gudgeon-pin, one scraper ring below.
CONNECTING RODS.—Forked rods are steel stampings machined all over. Anti-friction bearings.
CRANKSHAFT.—Four-throw 90° single-piece shaft running on five bearings.
CRANKCASE.—Elektron castings.
REDUCTION GEAR.—Spur gear type. Ratio 0.621 : 1.
SUPERCHARGER.—Centrifugal type.
CARBURATION.—Two Mona Type AO 58 horizontal carburetters mounted on rear of supercharger casing.
IGNITION.—Dual or two separate magnetos.
LUBRICATION.—Pressure type. Three pressure and two scavenge pumps.
DIMENSIONS.—Overall width 0.700 m. (27.5 in.), Overall length 1.600 m. (63 in.).
WEIGHT.—284 kg. (624.8 lbs.).
PERFORMANCE.—Take-off output 370 h.p. at 3,000 r.p.m., Output at 1,400 m. (4,590 ft.) 250 h.p. at 3,000 r.p.m.



The 370 h.p. Alfa 121 eight-cylinder inverted Vee air-cooled engine.

FIAT.



The 1,270 h.p. Fiat A38 RC 15-45 sixteen-cylinder inverted Vee liquid-cooled engine.

SOCIETÀ PER AZIONI FIAT.

HEAD OFFICE: CORSO IV NOVEMBRE 300, TURIN.

The Fiat Company was incorporated in 1898 and started on a bold policy which catered for all forms of locomotion. It began with motor vehicles and gradually extended its production to include tractors, heavy-oil engines, railway trucks, tanks, aircraft and aircraft engines, etc.

The vast, new and modern Mirafiori works in Turin were inaugurated in the Spring of 1939.

The first aero-engines were built in 1908; during the first World War the Fiat company contributed to the Allied victory with 15,000 aero-engines.

After the war 1914-18 the company pursued a very intensive research programme, especially on vee-type water-cooled engines, including the A.20, A.20S, A.20A, A.22T, A.22S, A.22R, A.24, A.24R, A.25, A.30RA, A.S.2, A.S.5 and A.S.6, all of which have been described in previous issues of this Annual.

This was the period during which the Italian aircraft, fitted with these engines, accomplished inter-continental and trans-Atlantic record flights, won such international competitions as the Bleriot and Schneider Trophies, and broke the international Speed, Distance and Altitude records.

In the last ten years, the majority of Italian aircraft were powered by Fiat air-cooled radial engines—A.50, A.50.S., A.52, A.54, A.55, A.58C., A.58R.C., A.59, A.59R., A.70, A.78C. and the later types A.74R.C.38S., A.74R.C.38D., A.74R.C.42, A.74R.C.18, A.80R.C.41, A.80R.C.20 and A.80R.C.40, all of which have also been described in previous issues of this Annual.

FIAT LIQUID-COOLED ENGINES.
THE FIAT A38 RC 15-45.

TYPE.—Sixteen-cylinder inverted 90° Vee, liquid-cooled.

CYLINDERS.—Bore 138 m/m. (5.44 in.), Stroke 145 m/m. (5.7 in.), Capacity 34.7 litres (2,117 cub. in.), Compression ratio 6.5 to 1. Monoblock type in light alloy with steel liners and attached to crankcase with studs. Each row of cylinders has an overhead camshaft controlling three valves for each cylinder, two intake valves and one exhaust.

PISTONS.—Drop-forged in light alloy with heat-dissipating fins Three compression rings and two oil scraper rings. Floating gudgeon-pins.

CONNECTING RODS.—Forked master-rod with bronze-lead alloy bearings fixed by pins. Auxiliary rod oscillates on the outside portion of the master-rod bearing.

CRANKSHAFT AND AIRSCREW DRIVE.—One piece eight-throw shaft on nine main bearings in bronze-lead alloy. End counter weights added. Reduction gear with ratio 1.666 to 1 of the Matteucci type with torsional vibration absorber incorporated, driving two Matteucci counter-rotating variable-pitch airscrews.

CRANKCASE.—One-piece in alluminium alloy.

SUPERCHARGER.—Two-speed centrifugal type with multiplying ratios of 6.712 : 1 and 8.3221 : 1, placed in the vee of the cylinders with axis normal to the crankshaft axis. Drop-forged light-alloy open-type rotor driven by straight teeth gears hydraulically controlled, with contrifugal clutches on both speeds. Fitted with ribbed diffuser and mixture collector.

IGNITION.—Four magnetos fitted in the front of the engine.

INDUCTION.—Zenith injection carburettor fitted with automatic mixture-control and automatic boost-control.

LUBRICATION.—Mineral oil, pressure type. Both pressure and scavenge pumps are of gear type.

COOLING.—Cooling liquid circulated by double-inlet double-bladed centrifugal pump.

STARTING.—Compressed-air starter with rotating distributor on end of each camshaft.

DIMENSIONS.—Length 1,977 m/m. (77.8 in.), Width 812 m/m. (32 in.), Height 1,162 m/m. (45.8 in.).

WEIGHT DRY.—With accessories 925 kg. (2,037 lbs.).

PERFORMANCE.—International rating at 2,800 r.p.m., Low blower gear 1,270 h.p. at 1,500 m. (4,940 ft.), High blower gear 1,200 h.p. at 4,500 m. (14,765 ft.), Normal output at sea level 1,200 h.p., Take-off rating with constant-speed airscrew 1,400 h.p. at 2,950 r.p.m.

FIAT AIR-COOLED RADIAL ENGINES.
General Features.

CYLINDERS.—Cylinder barrels of steel with internal surfaces nitrided. Detachable cylinder-heads in cast light alloy, heavily finned and screwed and shrunk on to cylinder barrels. Two valves with shrunk seatings. The exhaust valve is of the sodium-cooled type.

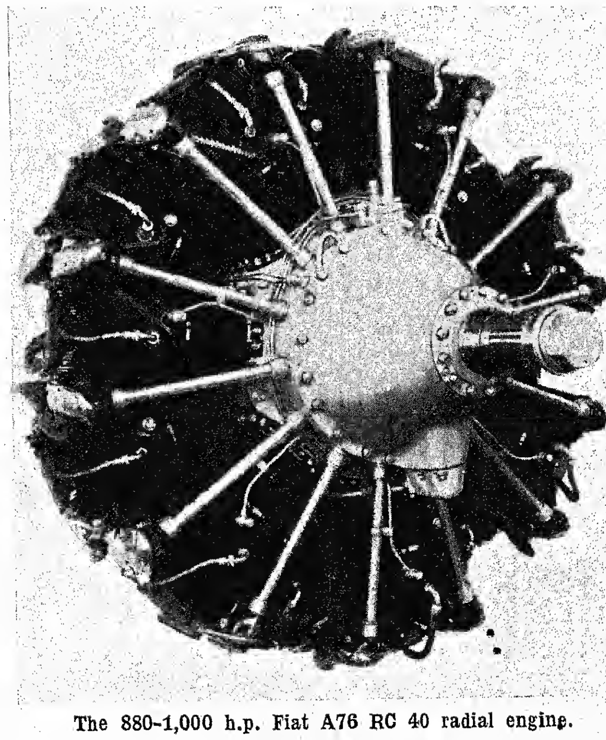
PISTONS.—Drop-forged of light alloy with heat dissipating fins on the underside of the crown. Three compression rings and two oil scrapers.

CONNECTING RODS.—Master rod in one piece with bosses for auxiliary rods.

CRANKSHAFT AND AIRSCREW DRIVE.—Built-up in three pieces with frontal teethed inserts. Cranks and bearings nitrided. The junction with the airscrew shaft is through an epicycloid reduction bevel-gear.

CRANKCASE.—Three main sections of light-alloy forgings.

SUPERCHARGER.—For A.74 type engine, centrifugal single-speed open



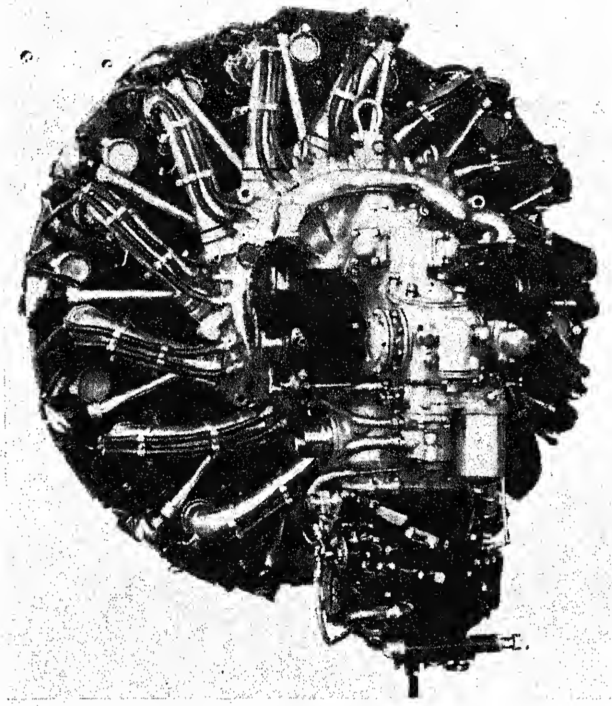
The 880-1,000 h.p. Fiat A76 RC 40 radial engine.

***FIAT**—continued.*

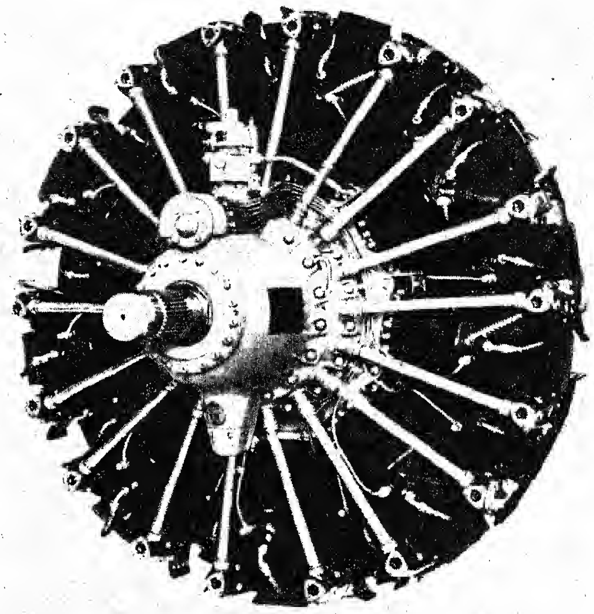
rotor, with three gear shafts, flexible coupling and centrifugal clutch. For the A.83 engine the supercharger is also centrifugal with two speeds through disc-clutch and free-wheel. On rotor-shaft a centrifugal clutch is mounted for safety. The speed changes automatically with the changing of the altitude by means of a hydraulic system. Centrifugal oil purificator is fitted.
INDUCTION.—Updraught carburettor fitted with automatic mixture-control and automatic boost-control.
IGNITION.—Two screened magnetos.
LUBRICATION.—Pressure type. Both the pressure and scavenge pumps are of gear type.
STARTING.—By compressed air, distributor.
AUXILIARY CONTROLS.—Drive for speedometer, universal drives, machine-gun synchronising gear control, generator and airscrew speed governor drives.

THE FIAT A76 RC 40.

TYPE.—Fourteen-cylinder two-row air-cooled radial, supercharged.
CYLINDERS.—Bore 140 m/m. (5.51 in.), Stroke 155 m/m. (6.1 in.), Capacity 33.4 litres (2,038 cub. in.), Compression ratio 6.7 to 1.
SUPERCHARGER.—Multiplying ratio 8.78 : 1.
REDUCTION GEAR.—Gear ratio 1.526 : 1.
DIMENSIONS.—Overall length 1,626 m/m. (64 in.), Diameter 1,232 m/m. (48.5 in.).
WEIGHT DRY.—With normal accessories 690 kg. (1,520 lbs.).



Rear view of the Fiat A76 RC 40 engine.



The 2,300 h.p. Fiat A83 RC 24-52 engine.

PERFORMANCE.—International rating 1,000 h.p. at 2,400 r.p.m. at 4,000 m. (13,120 ft.), Normal output at sea level 880 h.p. at 2,400 r.p.m., Take-off rating with constant-speed airscrew 1,000 h.p. at 2,520 r.p.m.

THE FIAT A76 RC 18S.

Identical to the preceding engine except for the following details.
SUPERCHARGER.—Multiplying ratio 7.532 : 1.
REDUCTION GEAR.—Ratio 1.475 : 1.
PERFORMANCE.—International rating 1,000 h.p. at 2,400 r.p.m. at 1,800 m. (5,900 ft.), Normal output at sea level 940 h.p. at 2,400 r.p.m., Take-off rating with constant-speed airscrew 1,050 h.p. at 2,520 r.p.m.

THE FIAT A83 RC 24-52.

TYPE.—Eighteen-cylinder two-row air-cooled radial, supercharged.
CYLINDERS.—Bore 140 m/m. (5.51 in.), Stroke 170 m/m. (6.7 in.), Capacity 47.1 litres (2,870 cub. in.), Compression ratio 6.75 : 1.
SUPERCHARGER.—Two-speed with multiplying ratios of 6.978 : 1 and 9,370 : 1.
DIMENSIONS.—Overall length 1,943 m/m. (76.5 in.), Diameter 1,341 m/m. (52.8 in.).
WEIGHT DRY.—With normal accessories 930 kg. (2,050 lbs.).
PERFORMANCE.—International rating at 2,300 r.p.m., Low blower gear 1,250 h.p. at 2,400 m. (7,875 ft.), High blower gear 1,250 h.p. at 5,200 m. (17,060 ft.), Normal output at sea level 1,150 h.p. at 2,300 r.p.m., Take-off rating with constant-speed airscrew 1,550 h.p. at 2,415 r.p.m.

ISOTTA-FRASCHINI.

FABRICA AUTOMOBILI ISOTTA-FRASCHINI.

HEAD OFFICE: MILAN.

The Isotta-Fraschini Company was incorporated in 1898 in Milan for the manufacture of automobiles and internal combustion engines, and since the earliest days of flying was engaged in the design and manufacture of aero-engines.

Before the War 1914-18 a number of Isotta-Fraschini engines were used in Italian airships, aeroplanes and seaplanes. During that War, nearly 5,000 Isotta-Fraschini engines were made, and nearly all the aero-engines produced in Italy were made under Isotta-Fraschini licence.

The most recent engines of Isotta-Fraschini design included the 700 h.p. Delta R.C. 351 and 500 h.p. Gamma R.C.151, both twelve-cylinder inverted vee air-cooled units; the 450 h.p. Astro 7.C.40 and 890 h.p. Astro 14.C.40, both air-cooled radials; the 900 h.p. Asso L.121.R.C.40 twelve-cylinder upright vee liquid-cooled; and the 1,500 h.p. Asso L.180 R.C.I.45 eighteen-cylinder inverted W liquid-cooled engine. All these engines have been described in previous issues of this Annual.

Since the war the company has been engaged mainly in overhaul and repair work.

PIAGGIO.

SOCIETA ANONIMÀ PIAGGIO & C.

HEAD OFFICE: GENOA.

This firm of railway-wagon manufacturers and shipbuilders, founded by the late Rinaldo Piaggio, entered the Aircraft Industry in 1916. A few years later the firm began to build aero-engines at Pontedera. It started by acquiring licences for Bristol and Gnôme-Rhône engines, and from the latter it developed its own series of engines.

This series included the 460 h.p. P.VII C.16, the 500 h.p. P.VII C.35 and P.VII C.45 seven-cylinder radials; the 700 h.p. P.X.R., 700 h.p. P.XVI R.C.35 and 625 h.p. P.X. R.C.35 nine-cylinder radials; the 1,000 h.p. P.XI *bis* R.C.40 fourteen-cylinder radial; and the 1,500 h.p. P.XII R.C.35 and 1,700 h.p. P.XXII R.C.35 eighteen-cylinder radial engines. All these engines have been illustrated and described previously in these pages.

Since the war the company has reverted to the manufacture of railway rolling-stock.

SPAIN

ELIZALDE.

ELIZALDE S.A.

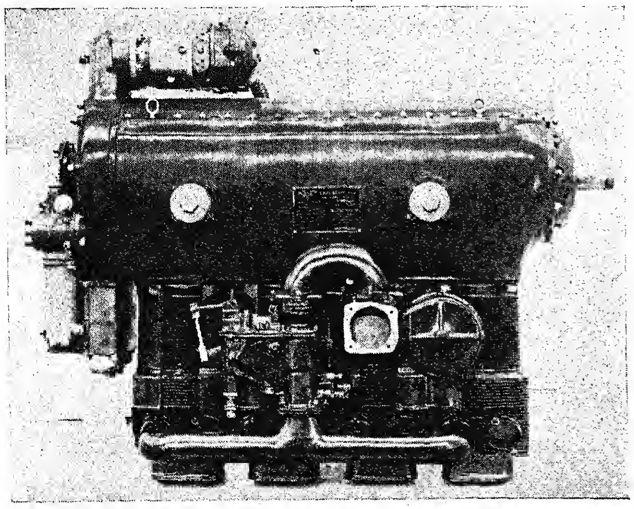
Head Office : Calle de Valencia 302, Barcelona.
Works : Paseo del General Mola, 39, Barcelona.
Managing Director : Don Julio de Renteria.

This important Spanish industrial concern had its origin in 1910 and made motor-cars until 1925. From that year it occupied itself with the manufacture of aviation engines exclusively. It began its career in this field by manufacturing Lorraine engines under licence and just prior to the outbreak of the Civil War produced two types of air-cooled engines, known as the Elizalde Dragon IX and Super-Dragon. These engines were fully illustrated and described in earlier editions of this Annual.

Having reorganized and re-equipped its factories and installations the company has resumed its activities with the design and development of a new series of low-powered engines known as the Tigre series. The first of the series is the four-cylinder Tigre IV, of which there are two models A and B with outputs of 125 and 150 h.p. respectively. These engines are described and illustrated herewith.

Under development in the series are engines of six, eight and twelve-cylinders which will be known as the Tigre VI, VIII and XII respectively. All will be derived from the Tigre IV but will be supercharged.

During 1944 the Elizalde company produced a new 450 h.p. seven-cylinder radial air-cooled engine, the Sirio S-VII-A.



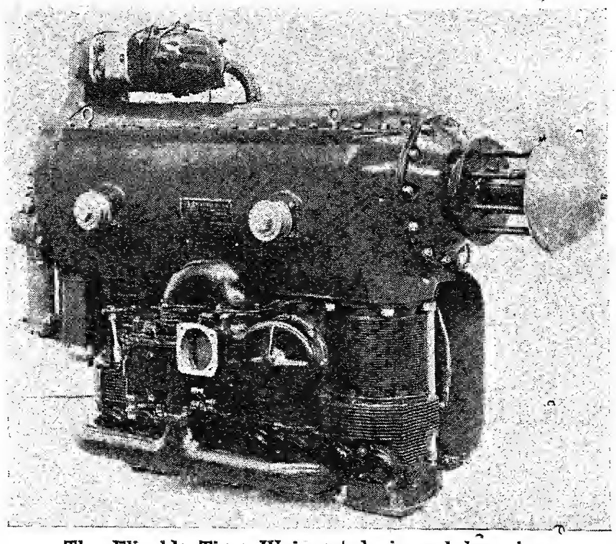
The Elizalde Tigre IV inverted air-cooled engine.

THE ELIZALDE TIGRE IVA and IVB.

Type.—Four-cylinder in-line inverted air-cooled.
Cylinders.—Bore 120 m/m. (4.72 in.), Stroke 140 m/m. (5.512 in.), Capacity 6.3 litres (386.3 cub. in.), Compression ratio 6 (IVA) or 6.5 (IVB) : 1. Cast Y-alloy cylinder heads. Forged and machined chrome-molybdenum steel barrels. Heads attached to barrels by six studs. Aluminium-bronze inlet valve seats. Austenitic steel exhaust valve seats.
Pistons.—Aluminium-alloy. Fully-floating gudgeon-pins.
Connecting Rods.—Forged aluminium-alloy. Copper-lead big-end bearings, special bronze small-end bearings.
Crankshaft.—Forged and machined chrome-nickel steel four-throw shaft on four copper-lead main bearings and one ball thrust bearing.
Crankcase.—Main case of Electron AZG-60. Forged aluminium-alloy top cover.
Carburation.—IRZ NB-60 carburettor.
Ignition.—Bosch dual magneto, type ZJ.4.CR5.
Lubrication.—Pressure by triple pump driven from rear end of camshaft. Triple oil filter.
Dimensions.—Length 1,114 m/m. (43.89 in.), Width 400 m/m. (15.76 in.), Height 877 m/m. (34.55 in.).
Weight.—120 kg. (264 lbs.).
Performance.—Normal output (type IVA) 125 h.p. at 2,200 r.p.m. (type IVB) 150 h.p. at 2,500 r.p.m.
Consumptions.—At normal output, Fuel 230 gr. (.507 lbs.) per h.p./hr., Oil 8 gr. (.0176 lbs.) per h.p./hr. At cruising output (7/10 power), Fuel 223 gr. (.491 lbs.) per h.p./hr., Oil 6 gr. (.0132 lbs.) per h.p./hr.

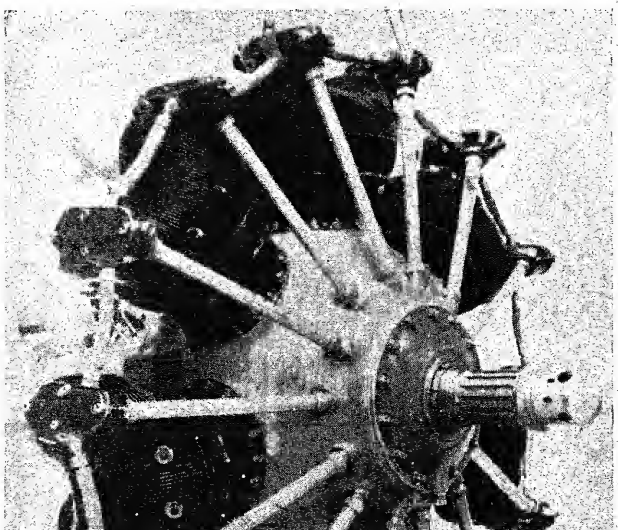
THE ELIZALDE SIRIO S-VII-A.

Type.—Seven-cylinder radial air cooled.
Cylinders.—Bore 150 m/m. (5.9 in.), Stroke 145 m/m. (5.75 in.), Capacity 17.92 litres (1,090 cub. in.). Finned steel barrels with cast aluminium head screwed on. One inlet and one sodium-cooled exhaust valve per cylinder.
Pistons.—Aluminium alloy. Floating gudgeon-pins. Three compression rings and two scraper rings.
Connecting Rods.—Master rod and six auxiliary connecting-rods carried on wrist pins. Lead alloy little-end bearings.



The Elizalde Tigre IV inverted air-cooled engine.

Crankshaft.—Single-throw shaft in two halves clamped and keyed together. On two roller bearings and one ball bearing for the tail shaft.
Crankcase.—Of cast Elektron, comprising the main case, a small front cover giving access to the distribution assembly and carrying the main thrust bearing, and a rear case and corresponding cover, which houses the compressor and all accessories. The rear crankshaft bearing rests on a flat platform of aluminium alloy which is rigidly secured to the main case.
Valve-Gear.—Fully-enclosed valve gear comprising push-rods, rocker-arms, etc. with pressure lubrication and scavenge return.
Lubrication.—Four pumps in the lower part of the rear crankcase, one pressure and three scavenge pumps. A filter at the outlet of the pressure pump is easily accessible for cleaning.
Ignition.—Two Scintilla automatic-advance magnetos.
Carburation.—One inverted IRZ carburettor with heater, warm air intake and automatic boost control.
Supercharger.—Centrifugal type with a gear ratio of 7.75 : 1.
Accessories.—Fuel pump, compressed air starter and couplings for electric generator, inertia starter, vacuum pump, tachometer and temperature and pressure gauges for fuel, oil, etc.
Octane Number.—80.
Diameter.—1,111 m/m. (43.7 in.) overall.
Weight.—295 kg. (650 lbs.) complete, but without electric generator and starter.
Performance.—Maximum power 450 h.p. at 2,300 r.p.m. at 2,500 m. (8,200 ft.), Power at sea level 430 h.p. at 2,300 r.p.m.



The 450 h.p. Elizalde Sirio S-VII-A radial engine.

HISPANO-SUIZA.

HISPANO-SUIZA FABRICA DE AUTOMOVILES, S.A.

Head Office: Avenida de José Antonio, 7, Madrid.
Aero-engine Works: La Sagrera, 279, Barcelona.
President and Chairman: D. Miguel Mateu Pla.
Managing Director: D. José Gallart Folch.

This company manufactures Hispano-Suiza engines for the Spanish Government, licences to build which it originally held from the French company. By the middle of 1939 the works at Barcelona had been re-conditioned after the Civil War and were in full production.

SWEDEN

SVENSKA.

SVENSKA FLYGMOTOR A.B.

Head Office: Trollhättan.
Works: Trollhättan, Göteborg, Skövde and Ulvsunda.

This concern was originally formed as the Nohab Flygmotorfabriker A.B. by the well-known Swedish engineering concern Nydqvist & Holm, to manufacture Bristol Mercury and Pegasus engines under a licence granted by the Bristol Aeroplane Co., Ltd., to the Swedish Government.

In 1941 the A.B. Volvo, of Göteborg, the leading Swedish motor company, bought a controlling interest in the Nohab concern, bought outright the Ulvsunda Verkstäder A.B. of Stockholm, and changed the name of the Nohabs Flygmotorfabriker A.B. to Svenska Flygmotor A.B., the resulting organization becoming the largest industrial engineering organization in Sweden with four well-equipped factories at Trollhättan, Göteborg (main Volvo works), Skövde (branch Volvo works), and Ulvsunda, near Stockholm. The share capital of the company has been increased from four to eight million Kroner, all shares being held by A.B. Volvo (62.5 per cent.) and A.B. Bofors (32.5 per cent.). The additional capital is to be used to expand Swedish aircraft-engine production.

The Trollhättan plant is one of the most extensive in Sweden and is situated close to the largest electric generating stations in Europe, power being obtained from the waterfalls alongside the factory.

The company has during recent years built under licence the Pratt & Whitney Twin-Wasp radial air-cooled engine and the Daimler-Benz DB605, twelve-cylinder inverted vee liquid-cooled engine. In 1946, the company obtained the licence to build the Goblin gas-turbine engine from the de Havilland Engine Co., Ltd.

The company has also produced a small four-cylinder air-cooled engine of 140 h.p. suitable for small civil aircraft, and a 210 h.p. six-cylinder engine of the same general design is under development.

THE SVENSKA MODEL F-451-A.

Type.—Four-cylinder horizontally-opposed air-cooled.

Cylinders.—Bore 125 m/m. (4.92 in.), Stroke 105 m/m. (4.14 in.), Capacity 5.1 litres, Compression ratio 6.5 : 1. Cylinder heads of high-grade aluminium-alloy castings, screwed and shrunk onto heat-treated alloy steel cylinder barrels. Intake and exhaust valve seats are aluminium-bronze and a special alloy steel respectively and shrunk into the cylinder heads. Bronze valve guides and aluminium bronze spark plug bushings are also shrunk into the cylinder heads. The cylinder barrel can be nitrided on special request.

Pistons.—Press-forged from a special aluminium-alloy and machined all over outside. Two compression rings, oil regulator ring and oil scraper ring. The piston pins of the full-floating type.

Connecting Rods.—Machined all over from alloy steel forgings. The crankpin end is fitted with a split steel-backed silver-lead bearing, and the piston pin end is fitted with a bronze bushing. The crankpin end is of the conventional split-type, the cap being secured with two bolts and nuts.

Crankcase.—Made in two parts from aluminium-alloy castings, joined by studs and nuts. Mating surfaces are precision machined, and no gasket is used between them.

Crankshaft.—Machined all over from alloy-steel forging and is dynamically balanced. The crankpins and journals are provided with centrifugal sludge remover oil tubes. The crankshaft is carried in three steel-backed silver-lead bearings, with a thrust ball bearing at the front end. Normally the crankshaft is delivered in a normally heat-treated condition, but on special request the bearing surfaces can be nitrided.

Valve Gear.—Hollow steel camshaft with case hardened lobes and journals located parallel to and below the crankshaft. Camshaft runs in bronze bushings in the crankcase and actuates mushroom type tappets. Tappets of a new zero-lash hydraulic type, for which a patent has been applied. Reciprocal action of tappets transmitted to valves through hollow steel push rods and steel rocker-arms.

Accessories.—Accessory housing is a machined magnesium-alloy casting located at rear of crankcase. Drives provided for magnetos, starter, generator, tachometer drive and various accessories.

Oil Sump.—An oil sump, which is made from a magnesium-alloy casting, is attached to bottom of crankcase and has a capacity of 10 litres. Oil sump also provides mounting for the carburettor and intake riser. Two ports are located on each side of sump connecting the intake pipes. Mixture is preheated during its passage through the channels in the oil sump, which facilitates vaporization.

Lubrication System.—Pressure. Oil pump located on the underside of crankcase feeds oil under pressure to various parts of the engine. There are no oil lines outside engine. Main bearings, connecting-rod bearings, camshaft bearings, tappets and push rods and various accessory drives are pressure-lubricated. Two oil filters incorporated in the oil system.

Ignition System.—Two magnetos firing two 14 m/m. spark plugs per cylinder. Ignition system can be shielded on request.

Dimensions.—Overall length 850 m/m. (33.5 in.), Overall height 560 m/m. (22.0 in.), Overall width 864 m/m. (34.0 in.).

Weight Dry.—135 kg. (297 lbs.).

Performance.—Rated output 140 h.p. at 2,600 r.p.m.

SWITZERLAND

WINTERTHUR.

THE SWISS LOCOMOTIVE AND MACHINE WORKS.

Head Office and Works: Winterthur.

The eight and twelve-cylinder engines manufactured by this firm have been described in previous issues of this book.

The firm is now building engines for the Swiss Government under licence from Hispano-Suiza.

THE UNITED STATES OF AMERICA

THE DESIGNATION OF AMERICAN SERVICE AERO-ENGINES.

The U.S. Army and Navy systems for the designation of aero-engines are similar. All service engines are designated by a letter indicating their basic type (*i.e.* R=radial, V=upright Vee, L=line, O=opposed), followed by the displacement of the engine in cubic inches to the nearest multiple of 5 and, finally, the Service model or modification number, (*i.e.* R-1830-65, V-1650-1, R-1820-56, R-2600-8, etc.). The final model or modification number of engines ordered to an Army specification is always an odd number. Engines ordered by the Navy always carry even model numbers. This applies even if the basic engine model is identical, so long as the engines are ordered separately. For example, the R-1830-9 (Army) is the same engine as the R-1830-64 (Navy), both being service versions of the Pratt & Whitney R-1830-SBG engine.

The designation of aircraft gas-turbine engines has also been standardised by agreement between the U.S. Army and Navy. The first letter in the designation distinguishes the type of unit, *i.e.* J—jet without propeller, T—gas-turbine with propeller. This is followed by a type number, beginning with 30 and a model number beginning with 1, all separated by hyphens. Even type numbers distinguish engines designed to a Naval specification and odd numbers those designed for the Army. An odd (Army) or even (Navy) model number distinguishes the origin of contract. For example :—

J-30-1	First Army version of first Navy jet engine.
J-30-2	First Navy version of first Navy jet engine.
J-31-1	First Army version of first Army jet engine.
J-31-2	First Navy version of first Army jet engine.
J-31-3	Second Army version of first Army jet engine,
	and so on.

In general, different type and model designations will be assigned to each new engine which differs in rating ; which is not interchangeable with respect to aircraft installations with previous models, or which has less important differences making recognition desirable for purposes of supply, maintenance, etc.

GAS TURBINE AND ROCKET ENGINES

AEROJET.

AEROJET ENGINEERING CORPORATION.

Head Office and Works : Azusa, California.
President : William O'Neill.
Vice-President and General Manager : A. H. Rude.
Vice-President : D. A. Kimball.
Director of Research : Dr. F. Zwicky.
Chief Engineer : K. F. Mundt.
Secretary and Treasurer : T. E. Beehan.

The Aerojet Engineering Corporation, an affiliate of the General Tire and Rubber Company, was formed in January, 1942, to produce rocket-units to provide aircraft with assisted take-off. The Corporation was the outcome of a project, known as the Air Corps Jet Propulsion Research Project, which consisted of a small group of scientists and engineers who, after discussions with the U.S. Army Air Forces, had began experiments at Arroyo Seco, near Pasadena, California, in 1939. Leading the group was Dr. Theodore von Kármán, director of the Guggenheim Aeronautical Laboratory at the California Institute of Technology.

Following the development of satisfactory JATO units, orders were fulfilled for the U.S.A.A.F. and the U.S. Navy. The plant was expanded to cover an area of 70 acres (32.82 hectares).

The Corporation is engaged in further developments in rocket propulsion but no details are available for publication.

ALLIS-CHALMERS.

ALLIS-CHALMERS MANUFACTURING COMPANY.

Head Office and Works : Milwaukee, Wis.

During the War this well-known engineering concern was licensed to build the de Havilland H-1 gas turbine. An Allis-Chalmers H-1 engine forms part of the power-plant of the Curtiss XF15C-1 experimental naval fighter.

Details of this company's current gas-turbine programme, which is officially sponsored, are not available for publication.

ALLISON.

ALLISON DIVISION, GENERAL MOTORS CORPORATION.

Head Office and Works : Indianapolis, Ind.

The Allison Division of the General Motors Corporation is in production with the General Electric I-40 and TG-180 jet engines under contracts with the U.S. Army Air Forces. Allison is actually the largest producer of jet engines in the United States although the engines produced are not of Allison design.

GENERAL ELECTRIC.

AIRCRAFT GAS TURBINE DIVISION, GENERAL ELECTRIC COMPANY.

Head Office : 920 Western Avenue, West Lynn, Mass.
Manager, Aviation Gas Turbine Division : E. S. Thompson.
Manager in charge of Engineering : H. D. Kelsey.
Design Engineer : S. R. Puffer.
Service Engineer : R. A. Hake.

The General Electric Company entered the gas-turbine field in October, 1941, when, by arrangement between the British and American Governments, a complete Whittle WIX engine, a set of drawings of the Whittle W2B, the prototype of the Rolls-Royce Welland engine, and a small team of engineers from Power Jets, Ltd. were flown to America to assist General Electric to initiate the manufacture of gas turbine engines in the United States.

The first experimental General Electric jet engine was the I-A, a copy of the Whittle W2B. This was followed by the I-14, the first experimental limited production engine, two of which were installed in the Bell XP-59A, the first U.S. jet-propelled aircraft to fly. The first flight of the XP-59A was made in October, 1942, within twelve months of the arrival of the Whittle engine and British engineers in the United States.

The first series production G.E. jet engine was the I-16, which was installed in the P-59A and also forms part of the power-plant of the Ryan FR-1 and the XF2R-1.

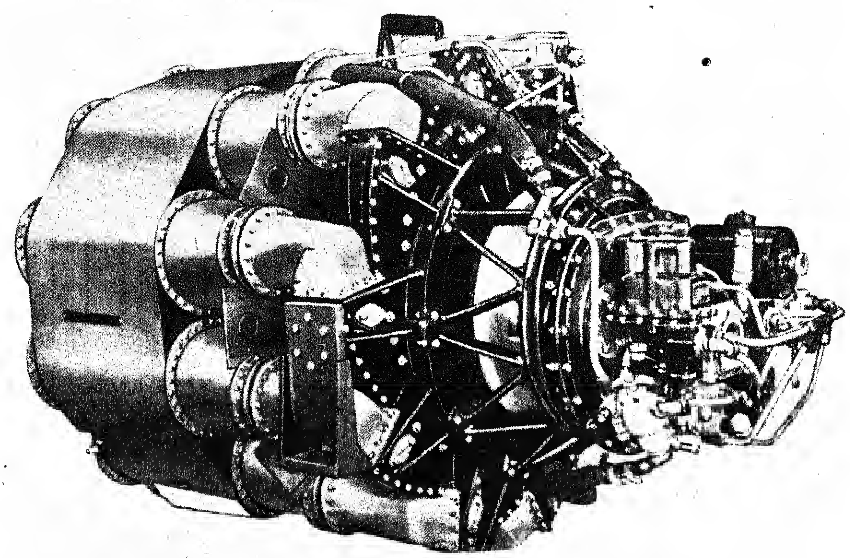
Early in 1943, at the request of the Army Air Forces, the General Electric Company started the study of a jet propulsion gas turbine of considerably higher rating than the I-16. The original design study was made for a gas turbine to have 3,000 lb. (1,361 kg.) static thrust. This design was revised to a gas turbine with 3,587 lb. (1,587 kg.) static thrust with the hope that development of the design in the future would allow an ultimate rating of 4,000 lb. (1,814 kg.) thrust. In the latter part of May it was decided that the proposal would be made for a gas turbine with 4,000 lb. (1,814 kg.) static-thrust at sea level standard conditions. This proposition became known as the Type I-40, and on June 26, 1943, it was decided to proceed with this development.

GENERAL ELECTRIC—*continued.*

Three months were spent completing the design and making drawings for the manufacture of the first development gas turbine. As soon as the drawings for each part were completed, work was started to produce it. Only six months later, in January, 1944, the first I-40 was completed and delivered to test. It was run up to 8,000 r.p.m. on January 13, 1944, just 6½ months after the start of the project. In subsequent tests this gas turbine was run at various speeds up to 8,700 r.p.m., a limit observed because the buckets of the first turbine wheel had an unfavourable tilt and were not considered satisfactory for operation at higher speeds.

The following performance data were obtained a month later, after a new turbine wheel had been installed. These data have been corrected to standard conditions of 14.7 lb./sq. in. (1.0335 kg./sq. c/m.) and 59°F. at the compressor inlet.

Speed	11,500 r.p.m.
Thrust	4,200 lb. (1,905 kg.).
Fuel Flow	5,070 lb./hr. (2,302 kg./hr.).
Exhaust Temperature	1,300°F. (700°C.).
Jet Diameter	18.2 in. (46.23 c/m.).



The General Electric I-16 (J-31) centrifugal-flow gas-turbine. (Static take-off thrust 1,600 lbs.=726.5 kg.).

The performance data were very gratifying but as the exhaust temperature was much higher than desired the jet diameter was increased to 19 in. (48.3 c/m.) in order to keep the exhaust temperature below the desired limit of 1,200°F. (650°C.).

Additional development I-40 gas turbines were completed each month for the next three months. The first three development models were used for performance and endurance tests at Lynn and were never installed in aircraft. After brief performance and operation tests, the fourth I-40 was shipped to the Lockheed Aircraft Corpn., and fitted in the first XP-80A. The first flight of the XP-80A Shooting Star was made at Muroc, Cal., on June 10, 1944, less than a year after the start of the I-40 project.

The I-40 is now in series production by the Allison Division of General Motors and is the standard power-plant of the P-80A.

The latest G.E. gas turbines which may be mentioned are the TG-180, an axial-flow turbojet, and the TG-100, a propeller turbine development of the TG-180.

THE GENERAL ELECTRIC I-16.

U.S. Army designation : J-31.

TYPE.—Single-stage centrifugal-flow gas turbine.

COMPRESSOR.—Single-stage centrifugal-flow compressor in a two-piece aluminium-alloy casing. Double-entry aluminium-alloy impeller with 32 vanes on each side, bolted to a flanged shaft which is coupled to the turbine rotor shaft by a splined sleeve. Shaft on two bearings, a ball-bearing in front of the compressor and a roller-bearing in front of the turbine rotor. Magnesium-alloy diffuser with ten tangential outlets and elbows connecting with the combustion chambers. Compression ratio 3.8 : 1.

COMBUSTION CHAMBERS.—Ten interconnected tubular stainless steel reverse-flow combustion chambers, each containing a perforated steel flame tube. One fuel injection nozzle in each flame tube. Stainless steel radiation shield around combustion chambers.

TURBINE.—Single-stage axial-flow turbine. Turbine nozzle ring with 44 inserted cast steel guide vanes. Turbine rotor of forged stainless steel with 56 inserted blades of nickel-molybdenum steel.

EXHAUST NOZZLE.—Stainless steel outer cone with heat-resisting shroud. Fixed inner cone.

FUEL SYSTEM.—Pesco 587E gear-type main injection pump with maximum pressure of 500 lbs./sq. in. (35.15 kg./sq. c/m.). Eclipse 1297 starter pump with pressure of 25 lbs./sq. in. (1.75 kg./sq. c/m.). G.E. 7HVB-16B2 barometric fuel control. G.E. 7HVT-16A1 throttle valve.

LUBRICATION.—Main bearings lubricated and cooled by air/oil mixture using air tapped from compressor. Purolator G-159J-21 filter.

STARTING.—G.E. 2CM42B3 direct-drive electric starter. Two igniter plugs in diametrically-opposite air-adapters, and G.E. 57GT00 ignition coil.

FUEL GRADE.—Kerosene (AN-F-32) or 100/130 Grade gasoline.

DIMENSIONS.—Diameter 41.5 in. (1,055 m/m.), Length 72 in. (1,830 m/m.).

WEIGHT.—850 lbs. (386 kg.).

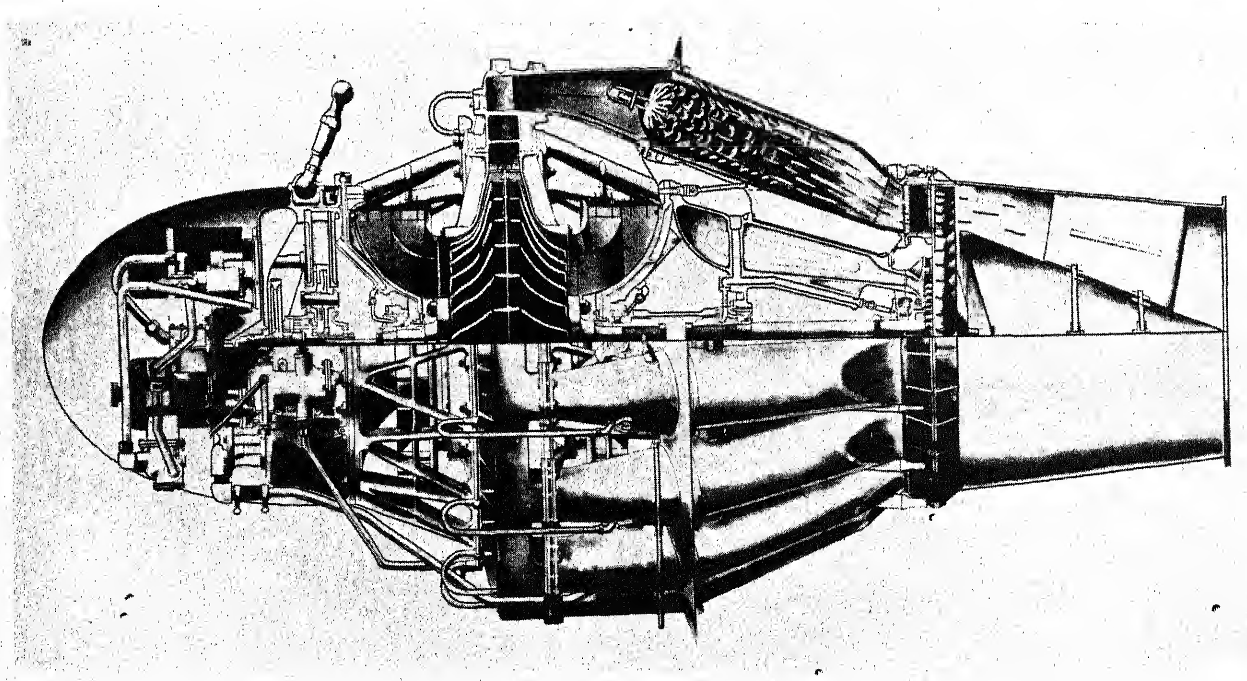
PERFORMANCE.—Take-off rating (static) 1,600 lbs. (726.5 kg.) thrust at 16,500 r.p.m., Normal rating (static) 1,425 lbs. (647 kg.) thrust 16,000 r.p.m.

THE GENERAL ELECTRIC I-40.

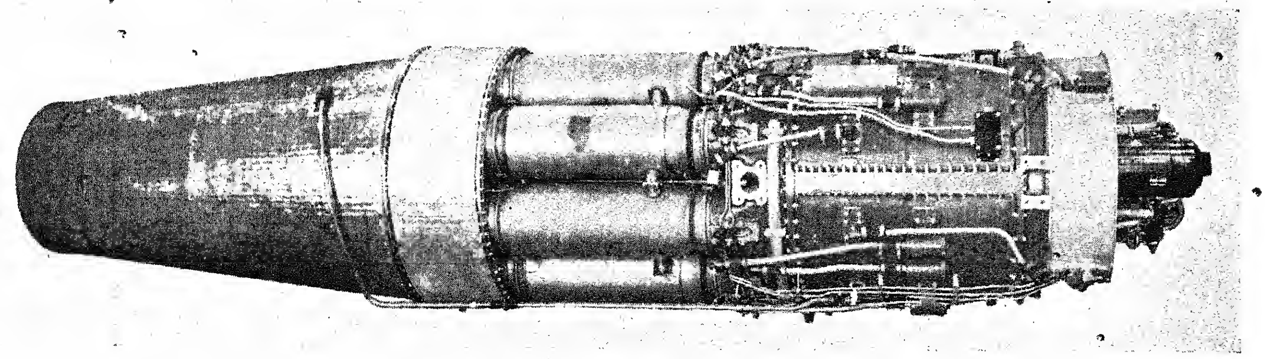
U.S. Army designation : J-33.

TYPE.—Single-stage centrifugal-flow gas turbine.

COMPRESSOR.—Single stage centrifugal-flow compressor. Double-entry impeller is a solid aluminium forging with 31 milled vanes each side,



The General Electric I-40 (J-33) centrifugal-flow gas-turbine. (Static take-off thrust 4,000 lbs.=1,814 kg.).



The General Electric TG-180 (J-35) axial-flow gas-turbine. (Static thrust 4,000 lbs.=1,814 kg.).

the inlet sections bent to match the incoming air flow. Impeller diameter 30 in. (76 c/m.), impeller inlet diameter 10.25 in. (26 c/m.). Magnesium-alloy diffuser with fourteen equally-spaced diffuser passages and Wirt-type elbows, each containing four integrally-cast turning vanes, connecting with combusting chambers through cast air adapters. Diffuser throat area 75 sq. in. (484 sq. c/m.). Impeller has stub shafts bolted on each side, the front shaft on ball-bearing and rear shaft on roller bearing. Flexible splined coupling to turbine shaft. Compression ratio 4.1 : 1.

COMBUSTION CHAMBERS.—Fourteen combustion chambers of stainless steel with their axis conical, joining together at the turbine inlet to provide axial flow. Each combustion chamber has perforated stainless steel flame tube inside. Fuel injection nozzle in front end of each flame tube.

TURBINE.—Single-stage axial-flow turbine. Rotor disc is flash-welded to shaft and has 54 inserted solid blades of special heat-resisting alloy-steel. Rotor carried by ball-bearing at front end and roller bearing at rear end. 48 cast steel nozzles mounted between two rings around the discharge of the combustion chambers. Rotor cooled by air tapped from outside engine nacelle. Turbine nozzle area 121.3 sq. in. (780 sq. c/m.), Turbine pitch diameter 22 in. (56 c/m.), Turbine nozzle and blade height 4 in. (10.16 c/m.).

EXHAUST NOZZLE.—Outer cone supports inner cone by four struts. Outer cone insulated by an aluminium foil and copper wire mesh blanket. Large front flange of outer cone acts as shroud to turbine blades. Small flange of outer cone serves as flange for tail pipe.

FUEL SYSTEM.—One Pesco 739CA gear-type main injection pump, maximum pressure 500 lbs./sq. in. (35.15 kg./sq. c/m.). Pesco 349P starter pump, pressure 25 lbs./sq. in. (1.75 kg./sq. c/m.). G.E. 7HVB-40A2 barometric fuel control. G.E. 7HGL-40A2 overspeed governor. G.E. 7HVTS-40A1 throttle valve.

LUBRICATION.—Dry sump system with oil reservoir in lower half of accessory casing. Pressure feed to four main bearings, splined coupling between turbine and compressor shafts and quill shaft splines driving accessory drive. Oil from front compressor bearing and from accessory drive quill shaft drains directly into oil reservoir. Oil from other three bearings and from main shaft coupling drains into sump from which it is scavenged and delivered back into reservoir. Gears and bearings in accessory drive casing lubricated by splash.

STARTING.—G.E.2CM95B10 direct-drive electric starter. Two igniter plugs in diametrically-opposite flame tubes. G.E. 7GT10-1 ignition coil.

MOUNTING.—Two horizontal trunnions and front support. Trunnions between air adapters at rear air inlet 2 in. (5.08 c/m.) forward of C.G. Front support can be mounted above or below depending on application.

ACCESSORY DRIVE.—By quill shaft off front end of main rotor shaft. Outer accessory drive casing carries various accessories, a rotor cage fitting inside carrying all gears and most of the bearings.

DIMENSIONS.—Diameter 52 in. (1,320 m/m.), Length (including tail pipe) 103 in. (2,615 m/m.).

WEIGHTS.—1,850 lbs. (840 kg.).

PERFORMANCE.—Take-off rating (static) 4,000 lbs. (1,814 kg.) thrust at 11,500 r.p.m., Normal rating (static) 3,200 lbs. (1,453 kg.) thrust at 11,000 r.p.m., Specific fuel consumption 1,185 lbs. (538 kg.) per hour per lbs. thrust.

THE GENERAL ELECTRIC TG-180.

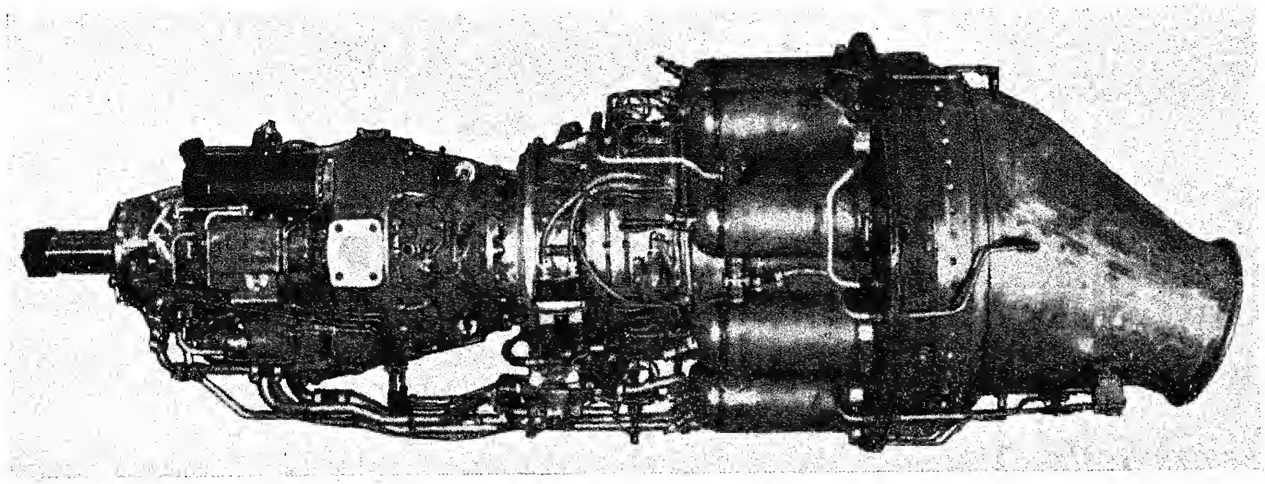
U.S. Army designation : J-35.

The TG-180 is an axial-flow gas turbine with an eleven-stage compressor, eight combustion chambers and a single-stage turbine. This engine, which develops a static thrust of 4,000 lbs. (1,814 kg.) at 7,600 r.p.m., is installed in the Republic XP-84, the Douglas XB-43 and in several experimental multi-engined bombers now under development. No further details are available for publication.

THE GENERAL ELECTRIC TG-100.

U.S. Army designation : T-31.

The TG-100 is a airscrew turbine which develops 2,200 propeller shaft h.p. plus 600 lb. (272.4 kg.) thrust. The TG-100 is fitted in the Consolidated Vultee XP-81 in conjunction with a G.E. I-40 gas-turbine. No further details are available for publication.



The General Electric TG-100 (T-31) airscrew-turbine, developing 2,200 shaft h.p. and 600 lbs. (272 kg.) static thrust.

MENASCO.

MENASCO MANUFACTURING COMPANY.

HEAD OFFICE AND WORKS : 805, SAN FERNANDO BOULEVARD, BURBANK, CAL.

President : John C. Lee.

Executive Vice-President and General Manager : Robert R. Miller.

Director, Power-plant Division : N. F. Price.

Before the war the Menasco Company was well-known as the manufacturer of a notable range of in-line air-cooled engines, of which the Pirate and Buccaneer were the most-used examples. In 1941 the company abandoned the production of engines of this type to participate in the U.S. national defence programme with the manufacture of hydraulic landing-gears, aircraft parts, etc. It also produced in the latter part of the war large numbers of small 22 h.p. two-cylinder internal-combustion engines for radio-controlled target drones.

In collaboration with the Lockheed Aircraft Corpn., Menasco had under development for some years a series of gas-turbine power units and in 1946 the company acquired the manufacturing rights of these engines, at the same time taking over the services of the entire Lockheed gas-turbine engineering staff headed by Mr. Nathan F. Price.

The Menasco gas-turbine programme includes a series of power-plants ranging from the largest military types down to units suitable for small civil aircraft. Menasco has also been assigned to undertake gas turbine development on behalf of the U.S. Army Air Forces.

NORTHROP-HENDY.

THE NORTHROP-HENDY COMPANY (Subsidiary of Northrop Aircraft, Inc.).

HEAD OFFICE: HAWTHORNE, CAL.

The Northrop-Hendy concern has been engaged in the development of a gas turbine engine under a military contract since 1941. Its Turbodyne I, which was first run in 1941, was the first propeller turbine to be tested in the United States. This engine, which is a large axial-flow unit with eighteen stages of compression and four turbine stages, is said to develop about 2,400 shaft h.p. but details are restricted and no information is available for publication.

PACKARD.

THE AIRCRAFT ENGINE DIVISION OF THE PACKARD MOTOR CAR COMPANY.

HEAD OFFICE AND WORKS: DETROIT 32, MICH.

The Packard Motor Company has developed and bench-tested a new type of turbo-jet engine as part of a project now being undertaken on behalf of the Air Materiel Command of the U.S.A.A.F. Details of this engine are restricted.

The company is building a new $3,500,000 gas-turbine laboratory at Toledo, which was scheduled for completion in the Spring of 1947.

PRATT & WHITNEY.

THE PRATT & WHITNEY AIRCRAFT DIVISION OF THE UNITED AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: EAST HARTFORD 8, CONN.

In 1946 the United Aircraft Corporation announced that the Pratt & Whitney Aircraft Division would enter the jet and turbine power-plant field and that substantial capital expenditure had been authorised for new engineering facilities to be devoted exclusively to the development of this type of power unit. Pratt & Whitney has collaborated with Westinghouse in the general mechanical design of the latter concern's turbo-jet engines, but it is now concentrating solely on the development of new gas turbines of its own design.

RMI.

REACTION MOTORS, INC.

HEAD OFFICE, WORKS AND LABORATORY: POMPTON PLAINS, NEW JERSEY.

President: Lovell Lawrance, Jr.

Reaction Motors, Inc. designed and built the first rocket-type power-unit for aircraft use to be developed in the United States. This engine, which carries the designation 6000C4, operates from the controlled combustion of a fuel (alcohol-water mixture) and an oxidizer (liquid oxygen), which are brought together in four steel cylindrical combustion chambers and expansion nozzles, of which any one or all can be operated at the same time. On a basic weight of 210 lbs. (95.3 kg.) the engine develops a maximum thrust of 6,000 lbs. (2,725 kg.) for a very limited period.

The first practical application of this unit is in the Bell XS-1, which has made many successful flights.

RANGER.

RANGER AIRCRAFT ENGINE DIVISION OF THE FAIRCHILD ENGINE & AIRPLANE CORPORATION.

HEAD OFFICE AND WORKS: FARMINGDALE, LONG ISLAND, N.Y.

The Ranger Aircraft Engine division of the Fairchild Corporation is understood to be developing an airscrew turbine engine for the U.S. Navy but no details of this project are available for publication.

TAYLOR.

TAYLOR TURBINE CORPORATION.,

HEAD OFFICE: NEW YORK.

The Taylor Turbine Corporation has been formed by Mr. Phillip B. Taylor, former Vice-President and Chief Engineer of the Wright Aeronautical Corpn., to import, assemble and, eventually, manufacture Rolls-Royce jet engines in the United States under licence from Rolls-Royce, Ltd. of England. Two Derwent V and two Nene I engines have been imported and have been submitted to official type-tests by the U.S. Navy and Army Air Forces. The first units built in America to specific American requirements are expected to be completed towards the end of 1947 or early in 1948.

WESTINGHOUSE.

WESTINGHOUSE ELECTRIC CORPORATION, AVIATION GAS TURBINE DIVISION.

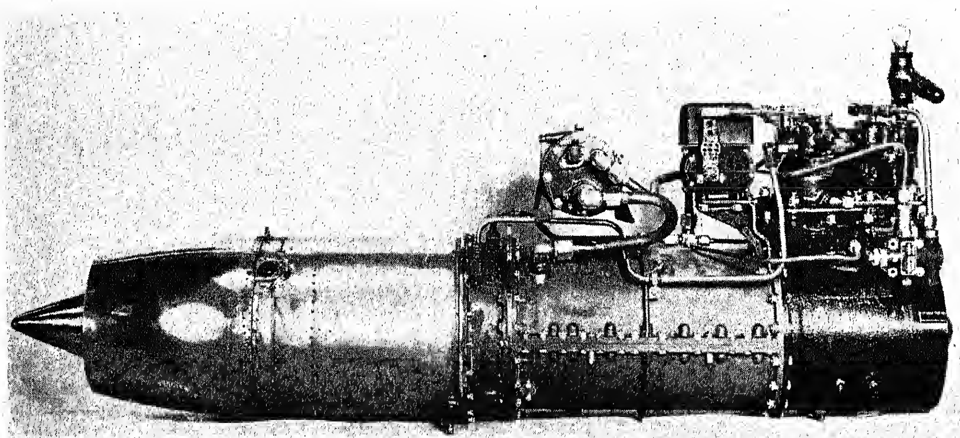
ADDRESS: LESTER BRANCH P.O., PHILADELPHIA 13, PENNSYLVANIA.

Division Manager: G. H. Woodard.
Manufacturing Manager: S. S. Stine.
Engineering Manager: R. P. Kroon.
Sales Manager: G. A. Hyland.

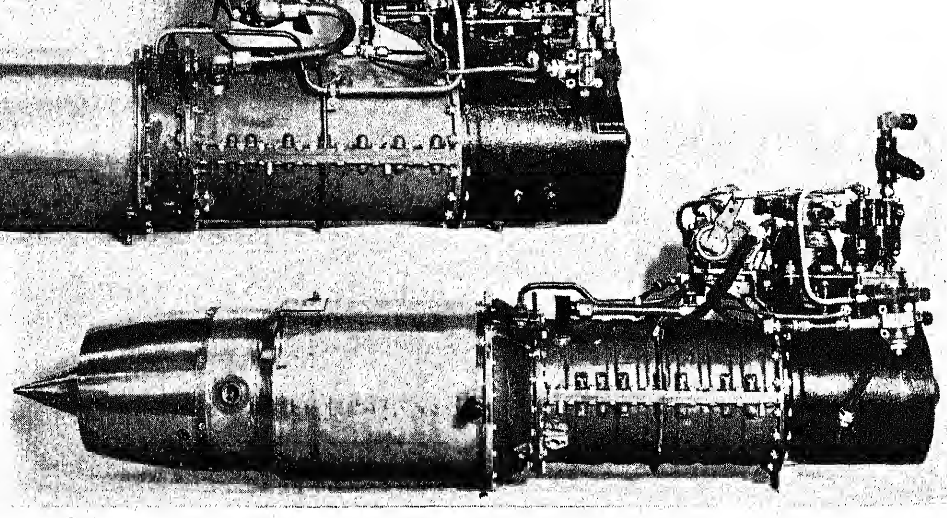
The Westinghouse Electric Corpn. began the development of aviation gas turbines in December, 1941, at the request of the U.S. Navy Bureau of Aeronautics.

The first Westinghouse jet engine, designated X19A, was completed in March, 1943. It first ran on the bench in that month and in January, 1944, the second X19A engine was test-flown by the U.S. Navy. In these test-flights the engine was mounted beneath the nose of a Chance Vought Corsair as a jet-booster unit. Six X19A engines were built and these were operated under varying conditions, ranging from static test-bed tests to flight tests up to 25,000 ft. (7,625 m.) at speeds of over 300 m.p.h. (483 km.h.).

On February 1, 1945, the Aviation Gas Turbine Division was established as a separate and independent operating division of the Westinghouse Electric Corpn.

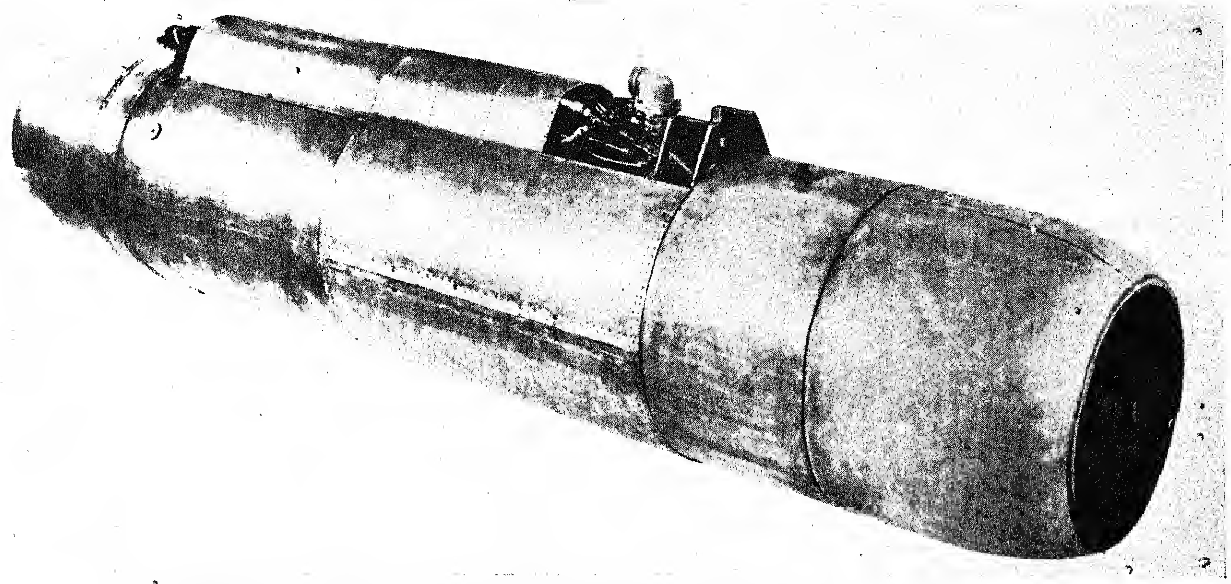


(Below) The Westinghouse X9.5B axial-flow turbo-jet engine (Static military thrust 275 lbs.=125 kg.).



(Above) The Westinghouse X9.5A axial-flow turbo-jet engine (Static military thrust 260 lbs.=118 kg.).

WESTINGHOUSE—*continued.*



The Westinghouse X19A axial-flow turbo-jet engine. (Static military thrust 1,363 lbs.=619 kg.).

In 3½ years Westinghouse had developed three basic jet engine sizes, and in each size from two to four distinct engine models or types. Four engines, the X9.5A, X9.5B, X19A and X19B, were brought successfully through the required acceptance tests. Three additional models, including a gas turbine with airscrew drive, are under development.

The X9.5A and X9.5B engines were designed primarily for pilotless aircraft or guided missiles; the X19A and X19B for powering conventional aircraft. The two X19B engines form the power-plant of the McDonnell FD-1, the first all-jet fighter designed and built for the U.S. Navy.

THE WESTINGHOUSE X9.5A.

Type.—Continuous-cycle Turbojet with single-stage turbine and six-stage axial-flow compressor.

Compressor.—One-piece forged aluminium-alloy rotor with projecting hub at front end over which a steel sleeve is shrunk for front journal, and flange at rear end which is rigidly bolted to flange on front end of turbine rotor-shaft. Six rows of steel rotating compressor blades held to rotor by ball roots. All rows of blades have the same tip diameter and tip speed. Two-piece cylindrical cast aluminium-alloy casing which holds five rows of stationery steel compressor blades and three rows of aluminium-alloy straightening vanes. Two mounting lugs at rear flange of compressor casing.

Combustion Chamber.—One cylindrical stainless steel combustion chamber which contains an annular burner basket. Holes in the sides of the burner admit airflow from the compressor. Fuel is sprayed into burner by twelve equally spaced nozzles located at extreme front of burner. Rear end of combustion chamber is connected to annular intake shroud of turbine. One mounting lug on rear of combustion chamber.

Turbine.—Annular stainless steel casing with one row of Vitallium alloy nozzle vanes. One-piece steel rotor disc with integral shaft. One row of twenty-four cast Vitallium alloy blades held on rotor by ball roots.

Exhaust Nozzle.—Welded stainless steel exhaust nozzle with streamline lagging around rear portion. Inner cone may be pre-set for back-pressure control.

Fuel System.—One Pesco 2P735-A positive displacement pump, capacity 0.227 cub. in./revolution. Twelve Monarch 6 gal./hr. FLP80 spray-nozzles. Parker 4091 GG-8D fuel strainer.

Bearings and Lubrication.—Compressor and Turbine rotor supported on one roller-bearing and one single-row ball-bearing. Roller-bearing is mounted forward of the overhung turbine and takes radial loads only. Thrust is taken by ball-bearing at front of compressor. Bearings are lubricated and cooled by spray of air and oil mixture using high-pressure air bled from compressor.

Starting System.—Two Eclipse 1313 or 1367 high-tension booster coils and two BG A3564A spark-plugs, one on each side of combustion chamber. Compressed-air starting on ground and ram starting in flight.

Control.—Westinghouse 36J365 all-speed governor.

Dimensions.—Width 10 3/16 in. (268 m/m.), Height 20¼ in. (542 m/m.), Length 49 31/32 in. (1,270 m/m.), Frontal area 1 sq. ft. (0.0929 sq. m.).

Weights.—Weight 145 lbs. (65.8 kg.), Weight/maximum thrust ratio 0.58.

Fuel Grade.—100/130 Grade gasoline.

Oil Grade.—AN-0-6.

Consumptions.—Fuel consumption (normal rating) 1.7 lbs./hr./lbs. thrust, Fuel consumption (military rating) 1.6 lbs./hr./lbs. thrust. Oil consumption 2.5 lbs./hr. (1.135 kg./hr.).

Performance.—Military rating (static) 260 lbs. (118 kg.), thrust at 34,000 r.p.m. at sea level, Normal rating (static) 149 lbs. (67.6 kg.) thrust at 28,000 r.p.m. at sea level, Military rating (altitude) 184 lbs. (83.5 kg.) thrust at 34,000 r.p.m. at 10,000 ft. (3,050 m.) at 600 m.p.h. (966 km.h.), Normal rating (altitude) 127 lbs. (57.6 kg.) thrust at 31,000 r.p.m. at 10,000 ft. (3,050 m.) at 600 m.p.h. (966 k.m.h.).

THE WESTINGHOUSE X9.5B.

The X9.5B is a development of the X9.5A, from which it differs in several design details.

Dimensions.—Width 10½ in. (265.3 m/m.), Height 21 7/16 in. (529 m/m.), Length 55 5/32 in. (1,403 m/m.), Frontal area 1 sq. ft. (0.0929 sq. m.).

Weights.—Weight 143 lbs. (65.2 kg.), Weight/maximum thrust ratio 0.52.

Fuel Grade.—100/130 Grade gasoline.

Oil Grade.—AN-0-6.

Consumptions.—Fuel consumption (normal rating) 1.7 lb./hr./lb. thrust, Fuel consumption (military rating) 1.55 lb./hr./lb. thrust, Oil consumption 2.5 lb./hr. (1.135 kg./hr.).

Performance.—Military rating (static) 275 lbs. (124.8 kg.) thrust at 36,000 r.p.m. at sea level, Normal rating (static) 175 lbs. (79.4 kg.) thrust at 29,800 r.p.m. at sea level, Military rating (altitude) 217 lbs. (98.5 kg.) thrust at 36,000 r.p.m. at 10,000 ft. (3,050 m.) at 600 m.p.h. (966 km.h.), Normal rating (altitude) 158 lbs. (71.5 kg.) thrust at 36,000 r.p.m. at 10,000 ft. (3,050 m.) at 606 m.p.h. (960 km.h.).

THE WESTINGHOUSE X19A.

Type.—Continuous-cycle Turbojet with single-stage turbine and six-stage axial-flow compressor.

Compressor.—One-piece forged aluminium-alloy rotor with projecting hub at front end over which a steel sleeve is shrunk for front journal, and flange at rear end which is rigidly bolted to flange on front end of turbine rotor-shaft. Six rows of steel rotating compressor blades held to rotor by ball roots. All rows have same tip diameter and tip speed. Two-piece cylindrical cast aluminium-alloy casing which holds five rows of stationary steel compressor blades and three rows of aluminium-alloy straightening vanes. Two mounting lugs, one on front of compressor casing and one at rear of combustion chamber cover.

Combustion Chamber.—Eight cellular combustion chamber units each containing three stainless steel burner cells closed at front ends, open at rear ends, and provided with large number of small holes to admit airflow from compressor. Front ends of combustion chamber units are connected to compressor outlet, and rear ends are connected to annular intake shroud of turbine. Fuel is injected through twenty-four nozzles, one in the closed end of each burner cell.

Turbine.—Annular stainless steel casing with one row of forty-five Vitallium-alloy nozzle vanes. One-piece stainless steel rotor disc with integral hollow steel shaft. One row of thirty-two solid Westinghouse K42B alloy blades attached to rotor by ball roots.

Exhaust Nozzle.—Welded stainless steel exhaust nozzle with insulating lagging around rear portion. Movable (two position) inner cone varies outlet area and permits back pressure control.

Fuel System.—One Pesco 2P689-A positive displacement fuel-pump, capacity 0.611 cub. in./revolution. Twenty-four Monarch 10.5 U.S. gal./hr. F80PLP spray nozzles. Fuel pressure 500-50 lbs./sq. in. (35.1-3.51 kg./sq. c/m.) depending on altitude. Purolator 303 fuel-strainer.

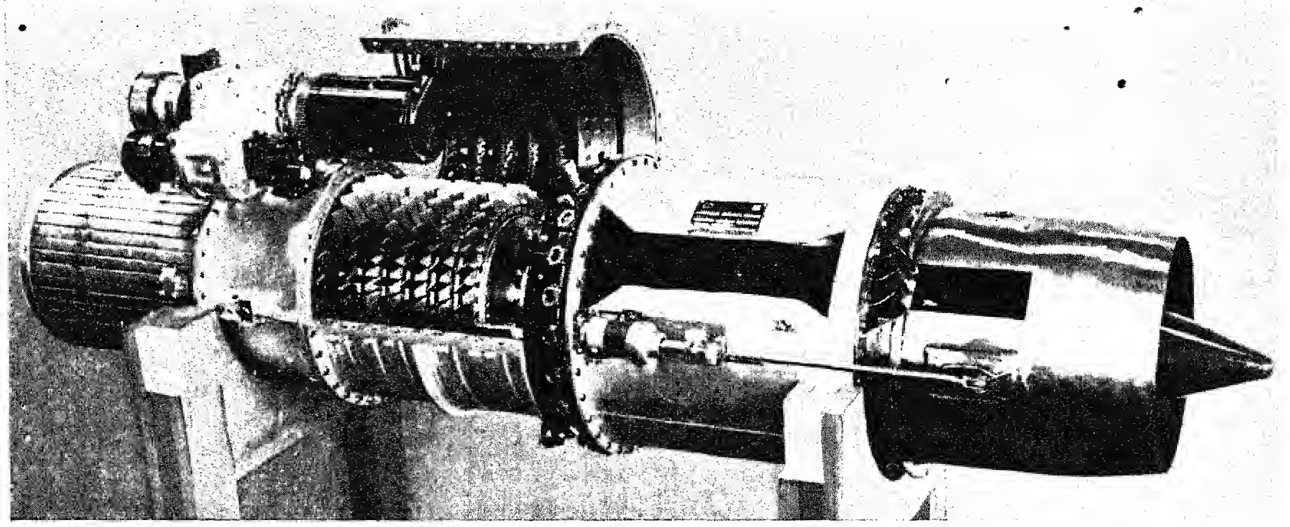
Bearings and Lubrication.—Compressor and turbine rotor supported on three bearings, a ball thrust-bearing in front of combustion chamber and two sleeve-type bearings, one in front of compressor and the other in front of the overhung turbine. One Pesco 694 pressure pump. One Nichols GC-176 scavenge pump. Two Purolator 303 oil filters. Pressure-feed to main bearings, 40 lbs./sq. in. (2.81 kg./sq. c/m.). Hollow cylindrical oil-cooler and reservoir attached to front of compressor.

Starting System.—Two Eclipse 1367 high-tension booster coils and twenty-four Champion Y-5 short-reach spark-plugs, one in each combustion chamber. Compressed-air starting on ground and ram starting in flight.

Control.—One Parker 5051-2-3/7D four-way manually-operated fuel (throttle) valve.

Dimensions.—Width 21.5 in. (549 m/m.), Height 19 in. (482 m/m.), Length 100.0 in. (2,532 m/m.), Frontal area 2.5 sq. ft. (0.2322 sq. m.).

***WESTINGHOUSE**—continued.*



The Westinghouse X19B axial-flow turbo-jet engine. (Static military thrust 1,365 lbs. = 620 kg.).

WEIGHTS.—Weight Dry 830 lbs. (376.8 kg.), Weight/maximum thrust ratio .61
FUEL GRADE.—100/130 grade gasoline.
OIL GRADE.—AN-0-6.
CONSUMPTIONS.—Fuel consumption (normal) 1.35 lbs./hr./lbs. thrust, Oil consumption (normal) 1 U.S. gal./hr. (3.78 litres/hr.).
PERFORMANCE.—Military rating (static) 1,363 lbs. (618.8 kg.) at 18,000 r.p.m. at sea level, Military rating (altitude) 657 lbs. (298.3 kg.) at 17,200 r.p.m. at 20,000 ft. (6,095 m.) at 300 m.p.h. (483 km.h.), Normal rating (altitude) 567 lbs. (257.4 kg.) at 16,260 r.p.m. at 20,000 ft. (6,095 m.) at 300 m.p.h. (483 km.h.), Normal rating (static) 1,157 lbs. (525.3 kg.) at 17,000 r.p.m. at sea level.

THE WESTINGHOUSE X19B.

The X19B is a production development of the X19A. Changes in design include externally mounted accessories for better accessibility, a new type burner chamber and various other minor improvements.
TYPE.—Continuous-cycle Turbojet with single-stage turbine and six-stage axial-flow compressor.
COMBUSTION CHAMBER.—One cylindrical stainless steel combustion chamber which contains a double annular burner basket. Holes in the sides of the burner admit airflow from the compressor. Fuel is sprayed into burner by twenty-four equally-spaced nozzles located at extreme front of burner. Rear end of combustion chamber is connected to annular intake shroud of turbine.
BEARINGS AND LUBRICATION.—Compressor and turbine rotor supported on three bearings, a ball thrust-bearing in front of combustion chamber and two sleeve-type bearings, one in front of compressor and the other in front of the overhung turbine. One Nichols C 26C43032D64-A pressure and scavenge pump. One Purolator 303 oil filter. Pressure fuel to bearings. Hollow cylindrical oil cooler forms air inlet at front of engine.
STARTING SYSTEM.—Two Eclipse 1367 high-tension booster coils and two Champion 49 spark plugs, one on each side of combustion chamber. Eclipse 41 direct-cranking electric starter with gear-reducer.
CONTROL.—One Westinghouse 29J974 fuel throttle valve. One Westinghouse 39J550 governor.
DIMENSIONS.—Width 25$\frac{27}{32}$ in. (656 m/m.), Height 25$\frac{11}{16}$ in. (653 m/m.), Length (tail out with oil-cooler) 104$\frac{15}{32}$ in. (2,654 m/m.), Length (tail out—without oil-cooler) 80$\frac{15}{32}$ in. (2,043 m/m.), Frontal area 3.8 sq. ft. (0.352 sq. in.).
WEIGHTS.—Weight (main power plant, with oil-cooler, generator and vacuum-pump) 826 lbs. (375 kg.), Weight (booster power unit, without oil-cooler, generator and vacuum or hydraulic pump) 785 lbs. (356 kg.).
FUEL GRADE.—100/130 octane.
OIL GRADE.—AN-0-6.
CONSUMPTIONS.—Fuel consumption (normal) 1.28 lbs./hr./lbs. thrust, Oil consumption (normal) 1 U.S. gal./hr. (3.78 litres/hr.).
PERFORMANCE.—Military rating (static) 1,365 lbs. (619.7 kg.) thrust at 18,000 r.p.m. at sea level, Normal rating (static) 1,175 lbs. (533.5 kg.) at 17,000 r.p.m. at sea level, Military rating (altitude) 525 lbs. (238.5 kg.) thrust at 18,000 r.p.m. at 30,000 ft. (9,145 m.) at 500 m.p.h. (805 km.h.), Normal rating (altitude) 465 lbs. (211.1 kg). thrust at 17,000 r.p.m. at 30,000 ft. (9,145 m.) at 500 m.p.h. (805 km.h.).

WRIGHT.

WRIGHT AERONAUTICAL CORPORATION (A DIVISION OF THE CURTISS-WRIGHT CORPORATION).

HEAD OFFICE: 30, ROCKEFELLER PLAZA, NEW YORK CITY, N.Y.

The Wright Aeronautical Corpn., a division of the Curtiss-Wright Corpn., is understood to be developing a large airscrew-turbine of its own design.

In addition, the Curtiss-Wright Corporation has acquired the exclusive rights in the United States aircraft field to certain gas-turbine patents and applications of the A. B. Ljungströms Angturbin (Lungströms Steam Turbine Co.) of Sweden. The agreement between the two companies involves a number of existing patents as well as a series of patents now on file in the U.S. Patent Office, together with any additional inventions that the Ljungströms company may make or acquire during the period of the agreement.

INTERNAL COMBUSTION ENGINES

ALLISON.

THE ALLISON DIVISION, GENERAL MOTORS CORPORATION.

HEAD OFFICE AND WORKS: INDIANAPOLIS 6, IND.
General Manager: E. B. Newill.
Assistant to General Manager: H. L. Wilson.
Chief Engineer: R. M. Hazen.
Assistant Chief Engineer: T. S. McCrae.
Works Manager: W. G. Guthrie.

The Allison Division of the General Motors Corporation is engaged in the production of high-performance liquid-cooled aircraft engines and reaction-propulsion power units.

The design and development of the Allison V-1710 twelve-cylinder vee liquid-cooled engine was initiated in 1930. The first V-1710-A completed a 50 hour development test at a rating of 750 h.p. at 2,400 r.p.m. in 1932.

The V-1710-B was a re-design of the A for airship use. It was unsupercharged and possessed a reversing feature which enabled the engine to be reversed from full power in one direction to the same condition in the other in 8 seconds. With the abandonment of the U.S. Navy rigid airship programme after the loss of the *Akron* and *Macon* further development of the B engine ceased. The first V-1710-C was delivered to the U.S. Army in 1933 and an engine of this type completed a 50 hour development test at a rating of 1,000 h.p. at 2,650 r.p.m. in the Spring of 1935. The first practical flight installation of the C model was made in 1937 in the Curtiss XP-37. This engine was the V-1710-C10 with exhaust-driven turbo-supercharger. The first altitude-rated C engine with integral supercharger, the V-1710-C13, was installed in the Curtiss XP-40 in 1938.

The D and E models were both produced to meet the requirements of the Bell Aircraft Corpn., the D to operate as a pusher and drive an airscrew through a 5 ft. (1.52 m.) extension shaft for installation in the XFM-1 Airacuda, and the E to drive a tractor airscrew through an 8 ft. (2.44 m.) extension shaft and remote gear-box for installation in the XP-39 Airacobra.

The development of the V-1710-F paralleled that of the E with which it was almost completely interchangeable. The F was designed for considerably higher outputs than the C model, had 10% less frontal area, a higher airscrew thrust-line, shorter overall length and was furnished in both right and left-hand tractor models.

General descriptions of the currently-used models are given hereafter. These include the F30, which weighs 1,395 lbs. (633.5 kg.) and has a take-off rating of 1,475 h.p., and the E30, weighing 1,660 lbs. (748.2 kg.), the latter equipped with an Allison-built auxiliary-stage supercharger assembly and capable of developing a maximum war emergency output of 1,825 h.p.

The V-1710 powers the North American P-82 Twin Mustang, the only conventional-powered fighter being produced for the U.S.A.A.F. in 1946. The latest model, on which delivery began in the Autumn is rated at 2,300 h.p. and two of these give the P-82 a maximum speed approaching 500 m.p.h. (800 km.h.).

Allison has also designed and built several types of "buried-engine" and shaft-drive installations, notably those of the Bell P-39 and P-63 and the Douglas XB-42.

ALLISON—*continued.*

The Allison Division is also engaged in the development and manufacture of aircraft reaction-propulsion units. It is in large-scale production with the General Electric I-40 (J-33) engine for the U.S. Army and has been the sole manufacturer of these engines for installation in the Lockheed P-80 since October, 1945.

THE ALLISON V-1710-F31R.

Type.—Twelve-cylinder 60° Vee liquid-cooled geared and supercharged.

Cylinders.—Bore 5.5 in. (139.7 m/m.), Stroke 6 in. (152.4 m/m.), Capacity 1,710 cub. in. (28 litres). Compression ratio 6.65 : 1. Two cylinder blocks of six cylinders each comprising a cast aluminium-alloy cylinder head, six hardened steel cylinder barrels and a cast aluminium-alloy cooling jacket. Barrels held in head by a shrink-fit and are enclosed by coolant jacket. Jacket secured to head by studs and to cylinders by nut threaded over each barrel. Each cylinder-block secured to upper half of crankcase by fourteen stud-bolts extending through the head. Combustion chamber has two intake and two exhaust valves and two diametrically-opposed sparking plugs. Steel intake valve inserts. Forged steel stellite-faced exhaust valve inserts.

Pistons.—Machined from aluminium-alloy forgings. Three compression rings above gudgeon pin, one keystone ring in the top groove and two conventional rings, and two oil-control rings in a single groove below. Floating gudgeon pin retained by snap rings at each end.

Connecting Rods.—Fork and blade type made from steel forgings machined and shot-blasted. Connecting rod bearing consists of two flanged steel shells lined with nickel-silver-tin, and is clamped in the forked end by two bearing caps. Centre portion of the outside diameter of the bearing is covered with an overlay of nickel-silver-tin which acts as journal for the blade rod. Blade rod fits around the overlay and is held in place by a single steel cap. Bronze bearings pressed into small end. Big-end bearings lubricated under pressure from crankshaft. Little-end bearings lubricated by splash.

Crankshaft.—Counter-balanced six-throw seven-bearing type. Each end of the shaft has a nine-bolt flange which provide mountings at the front for a flexible splined coupling for driving the reduction gear pinion and at the rear for a dynamic torsional vibration balancer. Splined to the hub of the dynamic balancer is the outer member of a hydraulic damper. An inner member is connected to the outer rigid member by a flexible quill shaft and reacts against the outer member through a hydraulic medium to minimize single-node low-frequency torsional vibration. This damper provides the driving connection between the accessories housing and the crankshaft.

Crankcase.—Two aluminium castings split on horizontal centre-line. Large studs on the face of the upper half pass through main bearing webs on lower half to clamp the two halves over the bearing shells. All main bearings are steel flanged shells lined with nickel-silver-tin. Centre main bearing provided with faced flanges which bear on the centre crank cheeks to provide axial location for the crankshaft. Cast magnesium-alloy oil pan bolts to the bottom of crankcase lower half and provides breathing passages between crankcase compartments. Oil is scavenged from both ends of the oil pan.

Valve Gear.—Two inlet and two exhaust valves per cylinder. Stellite-faced sodium-cooled nichrome-alloy valves. Single camshaft operates six rocker-arm assemblies on top of each cylinder-block. Each camshaft driven by bevel gears through separate inclined shafts from the accessory housing. Pressure lubrication through hollow camshaft.

Induction.—Bendix Stromberg Model PD-12K2 two-barrel injection type carburettor with automatic mixture control on rear of accessories housing. Supplies fuel directly on the supercharger impeller which delivers the fuel-air mixture to the ramshorn-type intake manifolds.

Supercharger.—Contained in the accessory housing and is driven from the flexible inner member of the hydraulic vibration damper. The impellor unit consists of two components, one having 15 radial vanes and the other 15 matched curved guide vanes, maintaining matched relationship through a common spline on the impeller shaft. Fuel-air mixture flows through a six-vane diffuser into the scroll and thence through the branched manifold system in the vee between the cylinder-blocks. Backfire screen in each branch manifold.

Ignition.—Dual high-tension Scintilla Type DFLN-5 magneto and two distributors driven by camshafts.

Airscrew Drive.—2 : 1 reduction. External spur gear. Airscrew shaft supported at front end by the ball thrust bearing and at the rear by a large roller-bearing. The pinion gear is mounted between two plain bearings and is splined to and driven by the crankshaft flexible coupling. The airscrew shaft-line is 8¼ in. (20.95 c/m.) above the crankshaft centre-line. The front scavenging oil pump is located in the reduction gear housing and the airscrew governor is mounted on the rear of the housing in the vee of the cylinder-blocks. The housing is also provided with oil passages to supply both governor and engine oil pressure for hydromatic airscrew operation. Reduction gear teeth are lubricated by an oil nozzle supplying three jets of oil directly on the teeth.

Lubrication.—Pressure system. Circulation maintained by single pressure pump and two scavenge pumps, all of the simple gear type. Constant pressure maintained by a pressure-sensitive balanced relief valve. Spring-loaded check valve prevents oil entering system when engine is stopped. Large tube in upper half of crankcase distributes oil to main bearings, through which it enters hollow portions of crankshaft. This tube also carries oil to reduction gears, reduction gear pinion bearings, and airscrew governor pad. Oil for accessory drives and valve gear is carried by tubes and drilled passages in accessory housing. Oil from valve gear drains to crankcase through passages at both ends of cylinder-block. Oil for the hydraulic vibration damper operation is also supplied from the engine pressure system.

Accessories.—Accessory housing mounted directly on the rear of the crankcase and contains the supercharger and drives for the coolant pump, camshafts, fuel pump, two vacuum pumps, main oil pump, tachometers, generator and magneto.

Dimensions, Weights and Performance.—See Table.

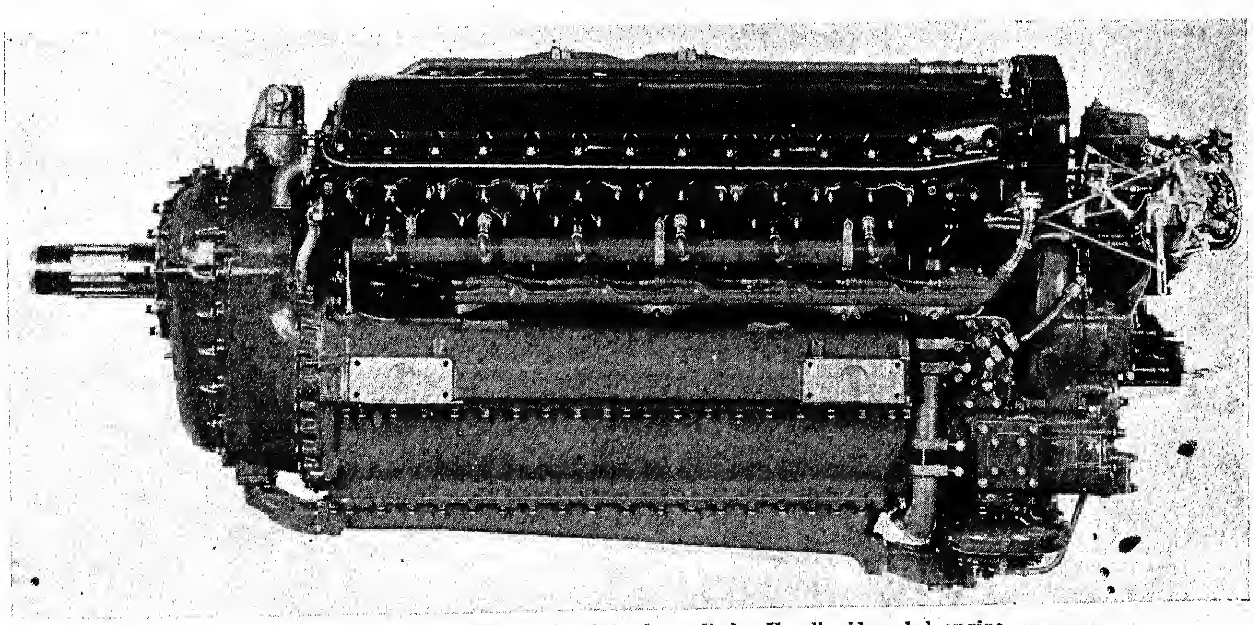
THE ALLISON V-1710-F30R and F30L.

The V-1710-F30R and F30L (right and left-hand airscrew drive), which were used in the Lockheed P-38L twin-engined fighter monoplane, are similar to the V-1710-F31R except that they are fitted with independently-mounted exhaust-driven turbo-superchargers.

THE ALLISON V-1710-E30.

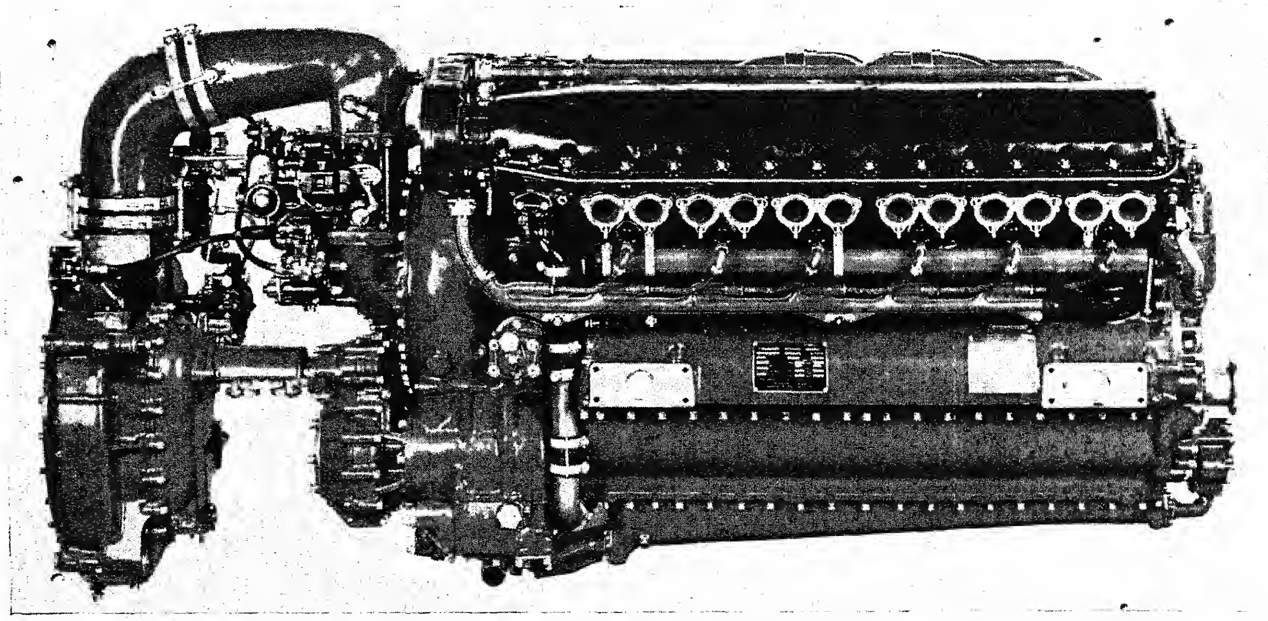
The V-1710-E30 is basically similar to the previously-described V-1710-F31R except that it has its external spur reduction gear driven by an 8 ft. (2.44 m.) extension shaft, and a variable hydraulic drive to a second-stage auxiliary supercharger. This engine is installed in the Bell Kingcobra in which the power-unit is mounted in the fuselage behind the pilot.

Airscrew Drive.—Outboard reduction gear box and airscrew mounting connected to the engine by an extension shaft composed of two flanged shafts, each 2.5 in. (63 m/m.) in diameter and 48 in. (122 m/m.) long and supported at the centre by a self-aligning ball-bearing mount. The reduction gear casing consists of two aluminium-alloy castings which support the airscrew shaft, thrust-bearing, reduction gear and pinion gear. The reduction gear is an external spur gear bolted to a flange on the airscrew shaft. The airscrew shaft is supported at the front end by a ballthrust-bearing and at the rear by a large roller-bearing. The pinion gear is mounted between two roller-bearings and is driven by the extension shaft through an internally splined flexible coupling. Reduction gear teeth are lubricated by an oil nozzle supplying three jets of oil directed on the teeth. A combined pressure and scavenge oil pump is mounted on the front of the reduction gear housing and provides oil pressure to the oil nozzle and scavenges the case. Oil is supplied from a separate external tank. On the rear face of



The 1,475 h.p. Allison V-1710-F30 twelve-cylinder Vee liquid-cooled engine.

ALLISON—*continued.*



The 1,500 h.p. Allison V-1710-E30 twelve-cylinder Vee liquid-cooled engine.

the casing drives are provided for two gun-synchronizers and an airscrew governor. Drive to the extension shaft is transmitted through a flexible splined coupling to a flange bolted to the front end of the crank-shaft.

WEIGHTS AND PERFORMANCE.—See Table.

THE ALLISON V-3420.

The V-3420 is a twenty-four-cylinder four-bank double-crankshaft version of the V-1710 for which an Air Corps experimental contract was originally received in 1937. It is virtually two V-1710 60° vee twelve-cylinder units mounted on a common crankcase with a 30° angle between the centre-lines of the inner banks of cylinders, the two side-by-side crankshafts being geared together to drive a single airscrew shaft.

Nearly all parts of the power section are interchangeable with the V-1710E and F series. These include crankshafts, connecting-rods, pistons, complete cylinder assemblies including valve-gear and holding-down studs, intake manifolds, ignition assemblies and radio shielding. This leaves only the crankcase assembly and main bearings which are not interchangeable.

The reduction gear bolts on to the front of the crankcase, and several parts of this gear are interchangeable with that of the V-1710-F model.

The accessory housing is designed for building up for either crankshaft rotation simply by the addition of an opposite-hand starter-dog. By special machining of the housing the crankshafts can be rotated in opposite directions to give a practically zero-torque power-plant, with advantages for single-engine installation.

Each crankshaft has its own damping provisions but the dampers are geared in such a way as to damp between shafts as well. With this arrangement practically any type of extension shaft and reduction gearing combination can be applied to the engine.

The engine is provided with a gear-driven single-speed supercharger, augmented by a General Electric exhaust-driven turbo-supercharger. Carburation is by a Bendix-Stromberg PT-12E1 three-barrel injection-type downdraught carburettor with automatic mixture control.

The first Army contract for this power-unit was for six V-3420-3 engines but this was modified in September, 1940, to six V-3420-5 with dual-rotation reduction-gear and extension shafts. Development was then shelved owing to the U.S. Army's need for the V-1710 engine and it was not until May, 1942, that a further contract was awarded for the development of an installation with a new two-stage supercharger suitable for the B-29. Further delays occurred and the first flight of the XB-39, as this aircraft was designated, did not take place until December 9, 1944. In the meantime the V-3420 had been earmarked for the P-75 fighter but by the time this aircraft was ready for production the U.S. Army did not feel justified in proceeding with the large-scale production of a new type at that stage of the war.

ALLISON LIQUID-COOLED ENGINES

Engine Type	V-1710-E19	V-1710-E30	V-1710-F30R and F30L	V-1710-F31R	V-3420
No of Cylinders ..	12	12	12	12	24
Bore and Stroke ..	5.5 in. × 6 in. (139.7 × 152.4 m/m.)	5.5 in. × 6 in. (193.7 × 152.4 m/m.)	5.5 in. × 6 in. (139.7 × 152.4 m/m.)	5.5 in. × 6 in. (139.7 × 152.4 m/m.)	5.5 in. × 6 in. (139.7 × 152.4 m/m.)
Capacity	1,710 cu. in. (28 litres)	1,710 cu. in. (28 litres)	1,710 cu. in. (28 litres)	1,710 cu. in. (28 litres)	3,420 cu. in. (56 litres)
Compression Ratio ..	6.65 : 1	6.00 : 1	6.65 : 1	6.65 : 1	6.65 : 1
Blower Ratio ..	9.6 : 1	8.1 : 1 (engine stage) 7.64 : 1 (auxiliary stage)	8.1 : 1 (plus turbo-supercharger)	9.6 : 1	—
Gear Ratio	0.488 :1	0.447 : 1	0.5 : 1	0.5 : 1	0.4 : 1
Octane No.	100	100/130	100	100	100
Take-off Power ..	1,200 h.p. at 3,000 r.p.m.	1,500 h.p. at 3,000 r.p.m.	1,475 h.p. at 3,000 r.p.m.	1,200 h.p. at 3,000 r.p.m.	2,600 h.p. at 3,000 r.p.m.
Ratings—Normal (max. continuous)	1,000 h.p. at 2,600 r.p.m. at 13,200 ft. (4,030 m.)	1,000 h.p. at 2,600 r.p.m. at 21,000 ft. (6,410 m.)	1,100 h.p. at 2,600 r.p.m. at 30,000 ft. (9,115 m.)	1,000 h.p. at 2,600 r.p.m. at 14,000 ft. (4,270 m.)	2,100 h.p. at 2,600 r.p.m. at 25,000 ft. (7,625 m.)
Military (15 min. only)	1,125 h.p. at 3,000 r.p.m. at 15,000 ft. (4,575 m.)	1,150 h.p. at 3,000r.p.m. at 27,500 ft. (8,390 m.)	1,475 h.p. at 3,000 r.p.m. at 30,000 ft. (9,150 m.)	1,125 h.p. at 3,000 r.p.m. at 15,000 ft. (4,575 m.)	2,600 h.p. at 3,000 r.p.m. at 25,000 ft. (7,625 m.)
Weight Dry	1,435 lb. (651.0 kg.)	1,660 lb. (753.6 kg.)	1,395 lb. (633.5 kg.)	1,385 lb. (628.8 kg.)	2,600 lb. (1180.4 kg.)
Dimensions :					
Length	194.00 in. (4,928 m/m)	208 in. (5,285 m/m)	85.81 in. (2,180 m/m)	85.81 in. (2,180 m/m)	100.00 in. (2.532 m/m)
Height	36.56 in. (930 m/m)	40.26 in. (1,021 m/m)	37.65 in. (930 m/m)	36.75 in. (932 m/m)	34.00 in. (863 m/m)
Width	29.28 in. (744 m/m)	29.28 in. (744 m/m)	29.28 in. (744 m/m)	29.28 in. (744 m/m)	56.00 in. (1,421 m/m)

ALLISON—*continued.*

The V-3420, therefore, never got beyond the experimental stage although considerable flying experience was gained with the engine in the Douglas XB-19A, the Fisher XP-75 and the Boeing XB-39.

Two basic engines are available, the A Series, in which both crankshafts rotate in the same direction, and the B Series, in which the crankshafts rotate in opposite directions. Individual engines in these Series developed during the war included the V-3420-5 with two 12 ft. (3.66 m.) extension shafts and single reduction-gear to drive contra-rotating airscrews; the V-3420-7, with T-drive from engine to right-angle gear-boxes for wing mounting, with extension shafts to airscrews; the V-3420-11 with right-hand airscrew drive; the V-3420-13 with left-hand airscrew drive and a different blower ratio; and the V-3420-15 with a 7.25 : 1 compression ratio.

Dimensions, Weights and Performance.—See Table.

CAMERON.

CAMERON AERO ENGINE CORPORATION.

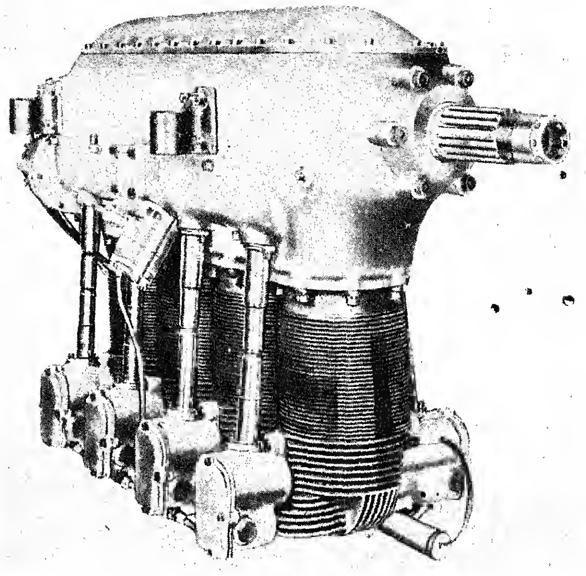
Head Office and Works: 545, North 3rd Street, Reading, Pennsylvania.

President: Everett S. Cameron.

The Cameron Aero Engine Corpn. has recently been formed to manufacture a series of air-cooled engines suitable for touring and training aircraft. Drawings and specifications have been prepared for a four-cylinder in-line inverted engine designed for 125 h.p.; a six-cylinder inverted engine designed for 185 h.p.; and a twelve-cylinder inverted vee engine designed for 370 h.p. The four-cylinder engine is being developed first, and an example of this engine was exhibited in public for the first time at the 1946 Cleveland Aero Show.

The special feature of the Cameron engine is the design of the cylinder combustion chambers and location of the intake and exhaust valves directly opposite each other and operating in a horizontal plane. The cool incoming charge impinges directly on the exhaust valve, cooling the valve and using the heat of the valve to volatilise the fuel/air mixture. The entire intake valve mechanism including valves, seats, guides and rocker-arms may be removed for inspection and overhaul without disturbing the cylinders. Exhaust rocker arms and shafts are removable from the housings without removing the housings from the cylinders and through the apertures caused by removing the intake valve housings the exhaust valves and seats are accessible for inspection and may be lapped in the cylinders.

Another feature of the engine is that it may be mounted in inverted or upright position, necessitating only slight changes in the oil leads.



The 125 h.p. Cameron C4-1-E1 engine.

THE CAMERON C4-I-E1.

Type.—Four-cylinder in-line inverted air-cooled.

Cylinders.—Bore 4¾ in. (120.6 m/m.), Stroke 4¼ in. (107.9 m/m.), Capacity 301 cub. in. (4.9 litres), Compression ratio 6.40 : 1. Cylinder barrel and head with external cooling fins cast in one in chrome-nickel alloy iron and machined all over.

Pistons.—Aluminium-alloy. Three compression and one oil control ring. Pistons drilled between oil control ring and gudgeon-pin boss for return of excess oil, and are internally ribbed.

Connecting Rods.—Machined from alloy steel and drilled for pressure lubrication to gudgeon pin. Split big-end contains steel-backed bearing identical to and interchangeable with crankshaft main bearing. "Oilite" bushing push-fitted in small end.

Crankshaft.—High carbon steel forging, hollow throughout for oil transmission and low weight. Supported on five steel-backed main bearings. Deep-groove radial ball thrust bearing, with combination plastic and synthetic rubber oil seal to prevent leakage between thrust bearing retainer and crankcase.

Crankcase.—Magnesium-alloy casting incorporating transverse integral webs at each main bearing location. Magnesium-alloy bearing caps. Full length cover plate.

Valve Gear.—One inlet and one exhaust valve, directly-opposed, in each cylinder. Inlet valve, valve seat, valve guide and rocker arm in two housings readily removable from cylinder. Exhaust valve and seat in cylinder, but exhaust rocker arms and shafts removable from housings. Alloy steel tube camshafts in crankcase, one on each side, with cam lobes keyed and brazed to shafts. Shafts driven through spur gears from rear end of crankshaft.

Carburation.—Stromberg Model PS5 injection carburetter on port side with cast magnesium manifold bolted to intake valve housings. Provision for ultimate fitting of direct fuel injection of Cameron design.

Ignition.—Dual ignition system consisting of two distributors, two high-tension coils and two plugs per cylinder. Radio shielding.

Lubrication.—Dry-sump system. Three-stage gear type engine-driven pump, containing one set of pressure and two sets of scavenge gears, on starboard side of engine.

Airscrew Drive.—Direct-drive. S.A.E. No. 10 spline. Standard fixed-pitch or controllable-pitch airscrew.

Accessories.—Accessory housing bolted to rear end of crankcase, providing mounting pads and drives for right and left ignition distributors or magnetos, starter, generator, fuel-pump and tachometer. Fuel-pump and tachometer drives on port and starboard side of accessory drive housing respectively; all other accessories mounted on the rear. All drives driven from a spur gear splined to rear end of crankshaft.

Dimensions.—Overall length (tip of airscrew hub to rear of starter) 45⅛ in. (1.147 m.), Lateral distance between centres of engine mountings 13¼ in. (0.336 m.), Longitudinal distance between centre of engine mountings 17¼ in. (0.427 m.).

Dry Weight.—Under 200 lbs. (91 kg.).

Performance.—Normal rated power 125 h.p. at 2,500 r.p.m. Recommended cruising power 110 h.p. at 2,200 r.p.m.

CONTINENTAL.

THE CONTINENTAL MOTORS CORPORATION, AIRCRAFT ENGINE DIVISION.

Head Office: Muskegon, Mich.

Works: Muskegon and Detroit, Mich.

President and General Manager: C. J. Reese.

Executive Vice-President and Secretary: B. F. Tobin, Jr.

Vice-President in charge of Engineering and Manufacturing: L. P. Kalb.

Vice-President and Manager, Aircraft Division: A. Wild.

Vice-President in charge of Sales and Service, Aircraft Division: D. H. Hollowell.

Chief Engineer, Aircraft Division: J. W. Kinnucan.

Treasurer: H. W. Vandeven.

In 1928, Continental Motors Corporation, one of the largest automobile engine manufacturers in the World, produced a sleeve-valve radial air-cooled aero-engine incorporating the Argyll (Burt-McCollum) patents, which had been purchased by the Corporation from the British Argyll Company in 1925.

In 1931 the 38 h.p. A40 flat-four was put on the market. This was followed by the A50, A65, A75 and A80 engines, the popularity of which resulted in over 8,000 Continental flat-four engines being produced up to the outbreak of war.

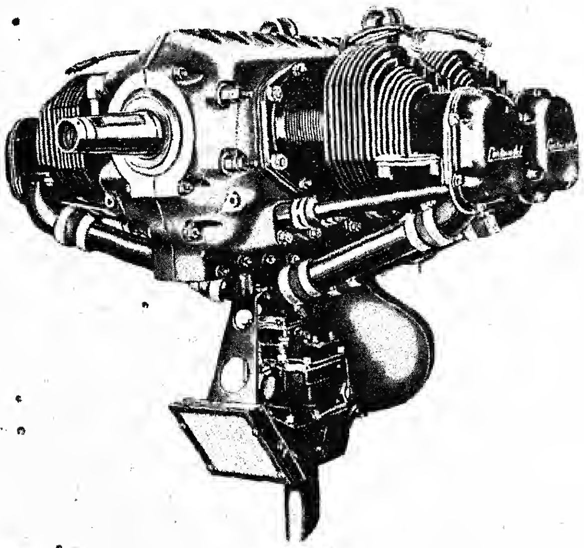
The Continental A65 engine was adopted by the U.S. Army under the designation O-170 as the standard engine for use in all light liaison aircraft of the "Grasshopper" type. Aircraft using this engine included the Taylorcraft L-2, Aeronca L-3 and Piper L-4.

The new post-war light engines now in production are the A65-8, C75-12, C85-12, A100-2, C115-2, C125-2, E165 and E185. In the larger engine class the R-9A and GR-9A nine-cylinder radials replace the former W-670 engines, which were used in training aircraft and tanks during the war and are now out of production.

During the latter part of the war the Continental Motors Corpn. was designated by the War Department to build the Packard Rolls-Royce Merlin V-1650 engine. Production began in 1944 in the company's Muskegon plant. The Detroit plant was then engaged in tank engine manufacture.

A subsidiary of the Continental Motors Corpn.—the Continental Aviation and Engineering Corpn.—was for many years engaged on the development of a high-powered liquid-cooled engine. This power-plant, which carried the designation I-1430, was a twelve-cylinder inverted 60° vee geared and supercharged engine with a cubic capacity of 1,425 cub. in. (23.3 litres). The most recent model had a war emergency power output of 2,100 h.p. at 3,400 r.p.m., which gave a power/weight ratio of .69 lbs./h.p. (0.312 kg./h.p.). The I-1430 was installed in a number of experimental types of aircraft, including fighters built by Curtiss, Bell, Lockheed and McDonnell.

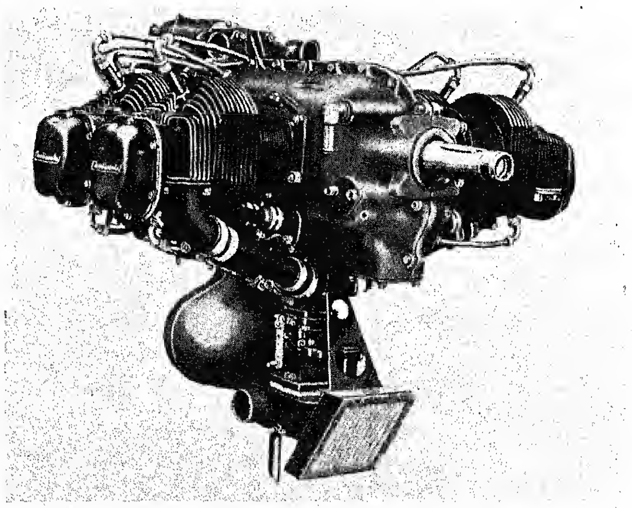
CONTINENTAL—*continued.*



The 65 h.p. Continental A65-8 engine.

THE CONTINENTAL A65 SERIES.

TYPE.—Four-cylinder horizontally-opposed air-cooled.
CYLINDERS.—Bore $3\frac{7}{8}$ in. (98.43 m/m.), Stroke $3\frac{5}{8}$ in. (92 m/m.). Capacity 171 cub. in. (2.8 litres). Compression ratio 6.3 : 1. Heat-treated cast aluminium-alloy heads screwed and shrunk on to forged-steel barrels. Valve-seat inserts and spark-plug bushings of aluminium-bronze. Bronze valve-guides.
PISTONS.—Lo-Ex duralumin-alloy. Trunk type. Full floating gudgeon pin located by end-plugs. Two compression, two scraper rings, one above and one below gudgeon pins.
CONNECTING RODS.—Forged steel. Split big-ends carry replaceable thin-shell steel-back cadmium bearings. Bronze bushings pressed into gudgeon pin ends.
CRANKSHAFT.—One-piece, four-throw, chromium-nickel-molybdenum steel forging, drilled for lubrication, runs in three steel-backed cadmium bearings, one of which is at middle of shaft. Plain thrust faces on airscrew-end throw and on shoulder near airscrew so that either tractor or pusher airscrews can be used.
CRANKCASE.—Two-piece heat-treated aluminium casting divided at vertical lengthwise plane through crankshaft. Rigid transverse webs carry main bearings and camshaft journals. Rawhide seal



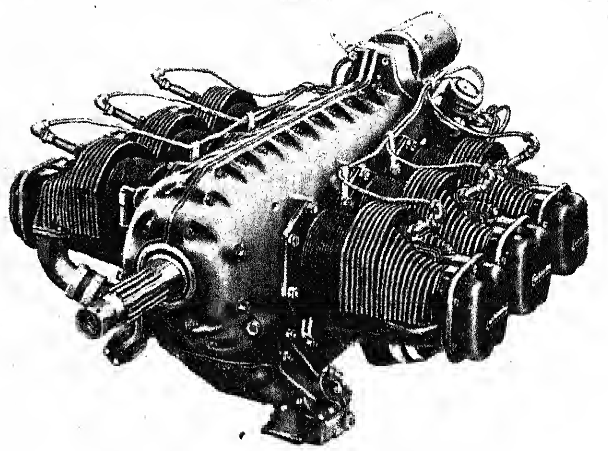
The Continental C75/C85 Series engine of 75-85 h.p.

prevents oil leakage at airscrew. Four engine-mounting bosses for $\frac{3}{8}$-in. (9.5 m/m.) bolts at rear of crankcase.
VALVE GEAR.—One hardened steel inlet-valve and one heat-resisting austenitic exhaust-valve per cylinder, each operated through rocker-arm, ball-ended push-rod and Wilcox-Rich hydraulic tappet, all sealed to prevent external oil leakage. Cast Proferall camshaft has six hardened cams (intake cams are common to opposing cylinders). Three hardened journals and overhung eccentric at airscrew end to run fuel pump.
INDUCTION SYSTEM.—Single up-draught Stromberg NA-S3A1 carburettor supplies mixture to cast-aluminium X-manifold with exhaust-heated hot-spot. Steel intake pipes connect manifold to intake ports. Fuel injection system available as alternative. Engine-driven injector runs at half engine speed and has four reciprocating plungers, one for each cylinder. Each supplies fuel to automatic discharge nozzle in intake pipe to each cylinder. Fuel flow to injector controlled by one needle valve in central passage from which all plungers are supplied. Constant-pressure engine-driven pump supplies fuel to injector unit. Air throttle valve at entrance to engine intake manifold. Manual control to injector unit adjusts mixture in flight.
IGNITION.—Eisemann AM-A dual magnetos.
LUBRICATION.—Oil at 30 lbs./sq. in. (2.11 kg./sq. c/m.) passes through hollow crankshaft to crank-pins and also passes through tappet, push-rod and rocker-arm to racker-arm bushing and valve-tip. Valve-stem and guide lubricated by splash. Oil returned to crankcase by way of push-rod housings. Pressure filter and relief-valve in crankcase.
AIRSCREW DRIVE.—R.H. tractor. Direct. No. 0 S.A.E. taper.
DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE CONTINENTAL C75 SERIES.

This Series includes the C75-12 and 12J with dual magnetos and Delco-Remy starter and generator and the C75-12F with flanged crankshaft. The J following the series number signifies that fuel injection is substituted for the Stromberg carburettor. The J engine is approximately $2\frac{1}{2}$ lbs. (1.12 kg.) heavier than the carburetted models.

General constructional details are similar to those of the previously described A65 Series. For other details see Table.



The 100 h.p. Continental A100 engine.

THE CONTINENTAL C85 SERIES.

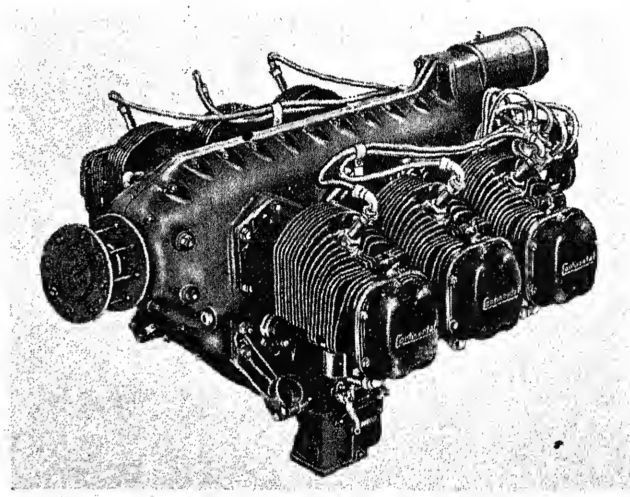
The C85 Series is identical to the C-75 Series except that the C85 carburettor has a $1\frac{1}{8}$ in. (29 m/m.) venturi as compared with $1\frac{5}{16}$ in. (33.2 m/m.) for the C75. The normal rated r.p.m. of the C85 is increased from 2,275 to 2,600 and the cruising r.p.m. from 2,125 to 2,400. The rated output is consequently increased from 75 to 85 h.p. For other details see Table.

THE CONTINENTAL A100 SERIES.

The A100 is a six-cylinder version of the A65, the principal parts and components of these two engines being interchangeable. There are two models, the A100-1 with the S.A.E. No. 10 splined crankshaft and the A100-2 with the S.A.E. No. 3 flanged shaft. For further particulars see Table.

THE CONTINENTAL C115-1.

The C115 is a six-cylinder horizontally-opposed engine using the cylinders of the C75 engine. General constructional details

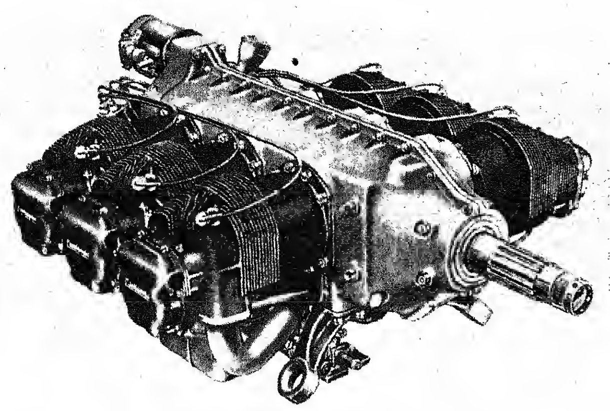


The Continental C115-C125 engine of 115-125 h.p.

CONTINENTAL—*continued.*

THE CONTINENTAL HORIZONTALLY-OPPOSED ENGINES.

Engine Model	Bore	Stroke	Capacity	Rated Output	Cruising r.p.m.	Weight Dry	Octane No.	Height	Length	Width
A65-8	$3\frac{7}{8}$ in. (98.43 m/m.)	$3\frac{5}{8}$ in. (92 m/m.)	171 cub. in. (2.04 litres)	65 h.p. at 2,300 r.p.m.	2,150	176 lbs. (79.9 kg.)	73	$20\frac{5}{16}$ in. (516 m/m.)	$30\frac{13}{32}$ in. (722 m/m.)	$31\frac{1}{2}$ in. (800 m/m.)
C75-12	$4\frac{1}{16}$ in. (103.2 m/m.)	$3\frac{5}{8}$ in. (92 m/m.)	188 cub. in. (3.08 litres)	75 h.p. at 2,275 r.p.m.	2,050	182 lbs. (82.6 kg.)	73	$21\frac{1}{4}$ in. (540 m/m.)	$31\frac{5}{8}$ in. (804 m/m.)	$31\frac{1}{2}$ in. (800 m/m.)
C85-12	$4\frac{1}{16}$ in. (103.2 m/m.)	$3\frac{5}{8}$ in. (92 m/m.)	188 cub. in. (3.08 litres)	85 h.p. at 2,575 r.p.m.	2,300	182 lbs. (82.6 kg.)	73	$21\frac{1}{4}$ in. (540 m/m.)	$31\frac{5}{8}$ in. (804 m/m.)	$31\frac{1}{2}$ in. (800 m/m.)
A100-2	$3\frac{7}{8}$ in. (98.43 m/m.)	$4\frac{1}{16}$ in. (103.2 m/m.)	256 cub. in. (4.2 litres)	100 h.p. at 2,350 r.p.m.	2,115	223 lbs. (101.2 kg.)	73	$24\frac{3}{4}$ in. (628 m/m.)	$41\frac{5}{8}$ in. (1,058 m/m.)	$31\frac{1}{2}$ in. (800 m/m.)
C115-2	$4\frac{1}{16}$ in. (103.2 m/m.)	$3\frac{5}{8}$ in. (92 m/m.)	282 cub. in. (4.6 litres)	115 h.p. at 2,350 r.p.m.	2,115	257 lbs. (116.6 kg.)	73	$24\frac{3}{4}$ in. (628 m/m.)	$41\frac{5}{8}$ in. (1,058 m/m.)	$31\frac{1}{2}$ in. (800 m/m.)
C125-2	$4\frac{1}{16}$ in. (103.2 m/m.)	$3\frac{5}{8}$ in. (92 m/m.)	282 cub. in. (4.6 litres)	125 h.p. at 2,550 r.p.m.	2,300	257 lbs. (116.6 kg.)	73	$24\frac{3}{4}$ in. (628 m/m.)	$41\frac{5}{8}$ in. (1,058 m/m.)	$31\frac{1}{2}$ in. (800 m/m.)
E165	5 in. (127 m/m.)	4 in. (101.6 m/m.)	471 cub. in. (7.6 litres)	165 h.p. at 2,050 r.p.m.	1,850	335 lbs. (152 kg.)	80	$25\frac{19}{32}$ in. (650 m/m.)	$46\frac{21}{32}$ in. (1,183 m/m.)	$33\frac{13}{32}$ in. (848 m/m.)
E185	5 in. (127 m/m.)	4 in. (101.6 m/m.)	471 cub. in. (7.6 litres)	185 h.p. at 2,300 r.p.m.	2,075	335 lbs. (152 kg.)	80	$25\frac{19}{32}$ in. (650 m/m.)	$46\frac{21}{32}$ in. (1,183 m/m.)	$33\frac{13}{32}$ in. (848 m/m.)



The Continental E165/E185 series engine of 165-185 h.p.

are the same as for the previously-described models. For further details see Table.

THE CONTINENTAL C125-1.

The C-125 is similar to the C-115 except that the normal rated r.p.m. is increased from 2,350 to 2,550, with a consequent step-up in power from 115 to 125 h.p. For further details see Table.

THE CONTINENTAL E165 AND E185.

These two six-cylinder engines were originally developed during wartime under Army supervision but have since been refined for civil use. The E165 develops its full 165 h.p. at the unusually low direct-drive airscrew speed of 2,050 r.p.m. In the E185 the r.p.m. is increased to 2,300 r.p.m. with a consequent step up in power to 185 h.p. Low-pressure fuel injection systems are optional equipment for both engines. For further particulars see Table.

THE CONTINENTAL R-9A AND GR-9A.

Type.—Nine-cylinder radial air-cooled, direct-drive (R-9A) or geared (GR-9A).

Cylinders.—Bore 5 in. (127 m/m.), Stroke $5\frac{1}{2}$ in. (194 m/m.), Capacity 971.9 cub. in. (15.9 litres). Compression ratio 6.3 : 1. Cast aluminium head screwed and shrunk on to a forged steel barrel.

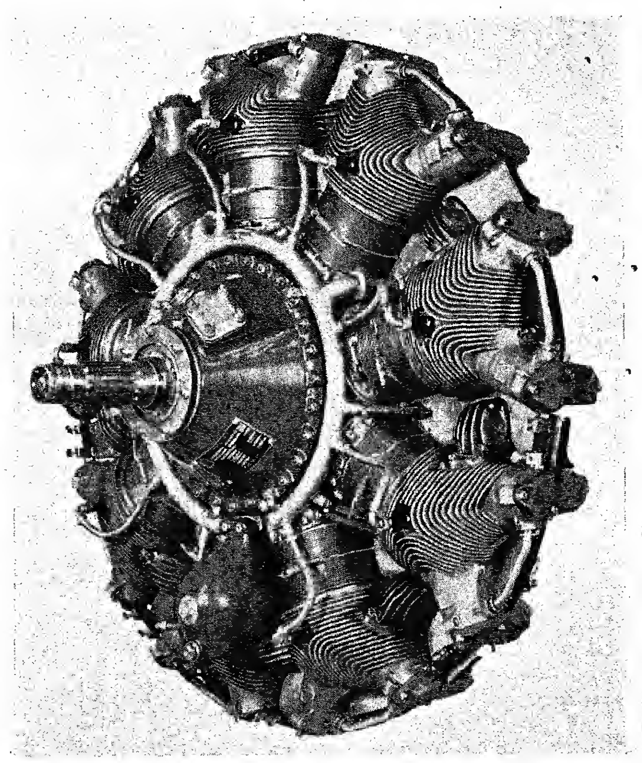
Pistons.—Forged aluminium. Three compression rings and one oil scraper ring above gudgeon-pin. Pin located by aluminium plugs.

Connecting Rods.—One master-rod and eight link rods of forged steel machined all over. Master-rod bearing of "silver-grid" type. This bearing consists of a steel shell with silver lining. The inner surface has a diamond-shaped "waffle-iron" pattern, the cavities of which are filled with babbitt metal.

Crankshaft.—Forged steel two-piece type, clamped at the rear cheek. Rear counterweight fitted with torsional vibration damper. Rear main bearing of "silver-grid" type.

Crankcase.—Cast aluminium, divided at front main bearing support.

Valve Gear.—Two inclined fully-enclosed valves per cylinder. Intake valve of forged steel with solid stem. Exhaust valve has sodium-filled hollow stem. Pressure lubrication.



The Continental 525 h.p. R-9A radial air-coooled engine.

THE CONTINENTAL R-9A AND GR-9A.

Engine Model	Take-off Power	Normal rated Horsepower	Recommended Cruising power	Gear Ratio	Weight Dry	Diameter	Length	Fuel Grade
R-9A	525 h.p. at 2,300 r.p.m.	500 h.p. at 2,300 r.p.m. at 4,000 ft. (1,220 m.)	330 h.p. at 2,100 r.p.m. at 8,500 ft. (2,590 m.)	—	705 lb. (320 kg.)	54.2 in. (1,146 m/m.)	42.5 in. (1,079 m/m.)	91/96
GR-9A	600 h.p. at 2,600 r.p.m. (1,625 airscrew r.p.m.) at 2,600 r.p.m.)	550 h.p. at 2,500 r.p.m. (1,563 airscrew r.p.m.) at 4,000 ft. (1,220 m.)	330 h.p. at 2,100 r.p.m. (1,313 airscrew r.p.m.) at 8,500 ft. (2,590 m.)	.625 : 1	745 lb. (338.2 kg.)	45.2 in. (1,146 m/m.)	43.9 in. (1,116 m/m.)	100/130

CONTINENTAL—*continued.*

Induction System.—Bendix Stromberg Type QD9A3 pressure-type automatic carburettor.

Supercharger.—Geared centrifugal type with 8.12 in. (20.6 c/m.) impeller running at 10.15 times crankshaft speed.

Ignition.—Two Scintilla magnetos with radio-shielded harness. Two Champion Model RC-35-S sparking-plugs per cylinder.

Lubrication.—Dry-sump type with full pressure lubrication to all journal bearings and to all rocker mechanisms.

Airscrew Drive.—Direct in R-9A. Epicyclic reduction gear (.625 : 1) in GR-9A.

Dimensions, Weight and Performance.—See Table.

FRANKLIN.

AIRCOOLED MOTORS, INC.

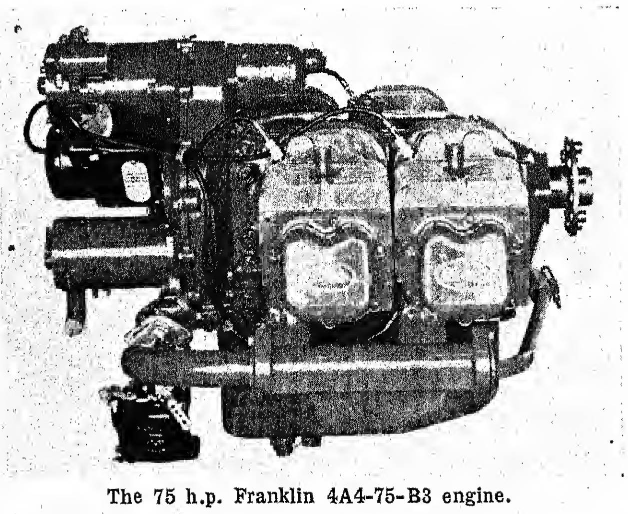
Head Office and Works: Syracuse, N.Y.
President and General Manager: C. F. B. Roth.
Vice-President and Chief Engineer: Carl T. Doman.
Secretary and Treasurer: A. A. Pieper.

In developing the Franklin aero-engine, Aircooled Motors, Inc. is carrying forward the experience of more than forty years. The Corporation owns the name, trade-mark and all the patents of the former Franklin Automobile Company under which all Franklin air-cooled engines are built. In 1945 the Corporation was bought by the Republic Aviation Corpn.

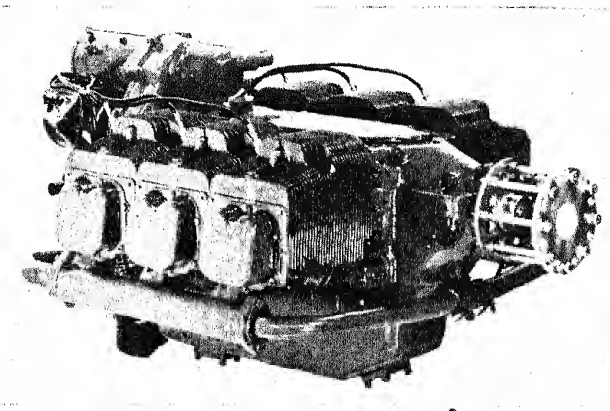
The Corporation produced the first of its very successful series of light horizontally-opposed air-cooled engines in 1938. Up to the outbreak of war it had placed on the market engines of four and six cylinders ranging in output from 65 to 150 h.p. It has been the object of the Corporation to design a series of engines so that it is possible to interchange parts to get a broad power range.

Aircooled Motors, Inc. has been very active in the development of self-cooled aircraft engines both for helicopter and conventional installations. A cooling-fan is incorporated as an integral part of the engine and together with air housings will permit a totally-submerged engine installation in either the vertical or horizontal position.

The pre-war models, having been redesigned, are obsolete and will no longer be manufactured. The new engines supplanting them comprise three basic models: a four-cylinder and two six-cylinder models covering a range of 75 to 225 h.p. All are horizontally-opposed and direct-drive.



The 75 h.p. Franklin 4A4-75-B3 engine.



The 130 h.p. Franklin 6A4-130-B3 engine.

FRANKLIN AIRCOOLED ENGINES.

Type.—Four or six-cylinder, horizontally-opposed direct-drive air-cooled.

Cylinders.—One-piece aluminium-alloy with removable iron liner. Attached to crankcase by integral hold-down flange and studs and nuts.

Pistons.—Trunk-type, aluminium-alloy permanent-mould. Two compression and one oil ring per piston.

Crankshaft.—One-piece steel forging with SAE standard airscrew shaft flange. Main and connecting rod bearings steel-backed and copper-lead faced.

Crankcase.—Aluminium-alloy in two halves, split vertically. Detachable wet oil-sump underneath.

Valve Gear.—One overhead inlet and overhead exhaust valve per cylinder actuated by push-rods through rocker-arms with adjustable tappets. Wilcox-Rich hydraulic valve lifters provide zero-clearance regardless of engine temperature. Valve-gear totally enclosed and internally lubricated.

Carburation.—Marvel-Schebler float-type carburettor with altitude-control and idle cut-off, or Bendix-Stromberg pressure-type non-icing carburettor. Not optional.

Remarks.—Some models are entirely self-cooled by means of an integral axial-flow fan directly connected to the crankshaft. Air housings are provided which make these engines suitable for submerged installations.

THE FRANKLIN 4A4-B3.

Type.—Four-cylinder horizontally-opposed air-cooled.

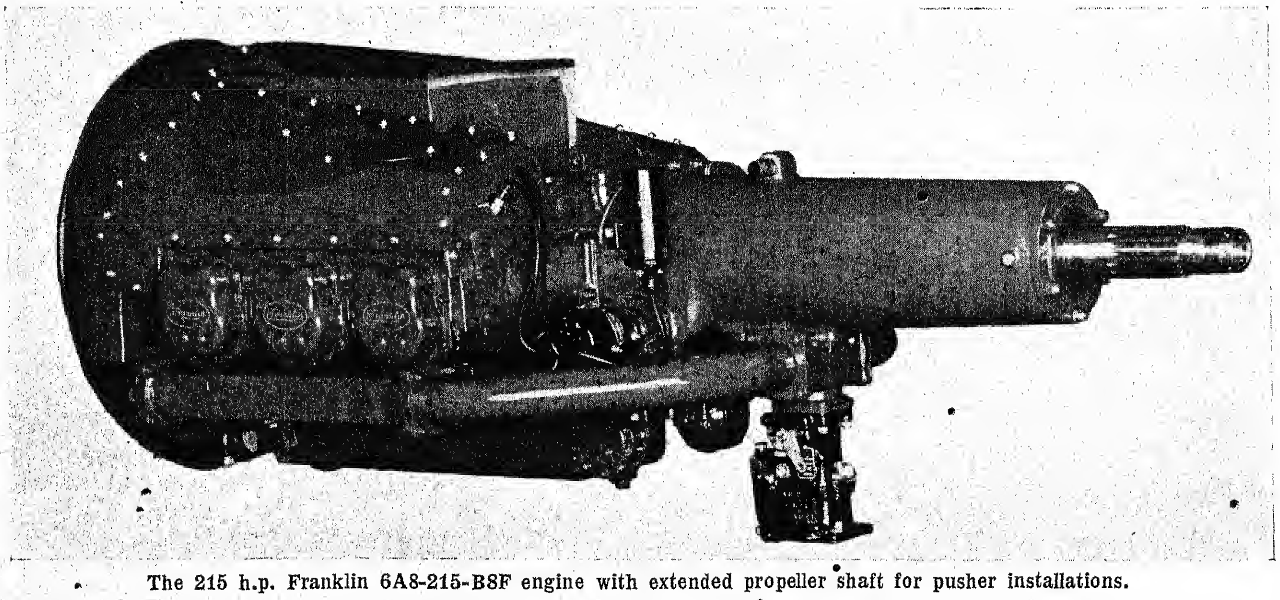
Cylinders.—Bore $4\frac{1}{2}$ in. (114.3 m/m.), Stroke $3\frac{1}{2}$ in. (88.9 m/m.), Capacity 225 cub. in. (3.6 litres), Compression ratio 7.0 : 1.

Octane No.—80.

Accessories.—Dual magnetos, float-type carburettor, 12 volt starter, generator. Fuel pump optional.

Weights.—230 lbs. (104.4 kg.) with starter and generator.

Performance.—Rated output: 75 h.p. at 1,950 r.p.m. (4A4-75-B3), 85 h.p. at 2,200 r.p.m. (4A4-85-B3), 100 h.p. at 2,550 r.p.m. (4A4-100-B3).



The 215 h.p. Franklin 6A8-215-B8F engine with extended propeller shaft for pusher installations.

FRANKLIN—*continued.*

THE FRANKLIN 6A4-B3.

Type.—Six-cylinder horizontally-opposed air cooled.
Cylinders.—Bore $4\frac{1}{2}$ in. (114.3 m/m.), Stroke $3\frac{1}{2}$ in. (88.9 m/m.), Capacity 335 cub. in. (5.5 litres), Compression Ratio 7.0 : 1.
Octane No.—80.
Accessories.—Dual magnetos, float-type carburettor, 12-volt starter, generator, oil cooler. Fuel pump optional.
Weights.—320 lbs. (145.3 kg.) with starter, generator and oil-cooler.
Performance.—Rated output : 130 h.p. at 2,200 r.p.m. (6A4-130-B3), 140 h.p. at 2,375 r.p.m. (6A4-140-B3), 150 h.p. at 2,600 r.p.m. (6A4-150-B3).

THE FRANKLIN 6V4-178-B3.

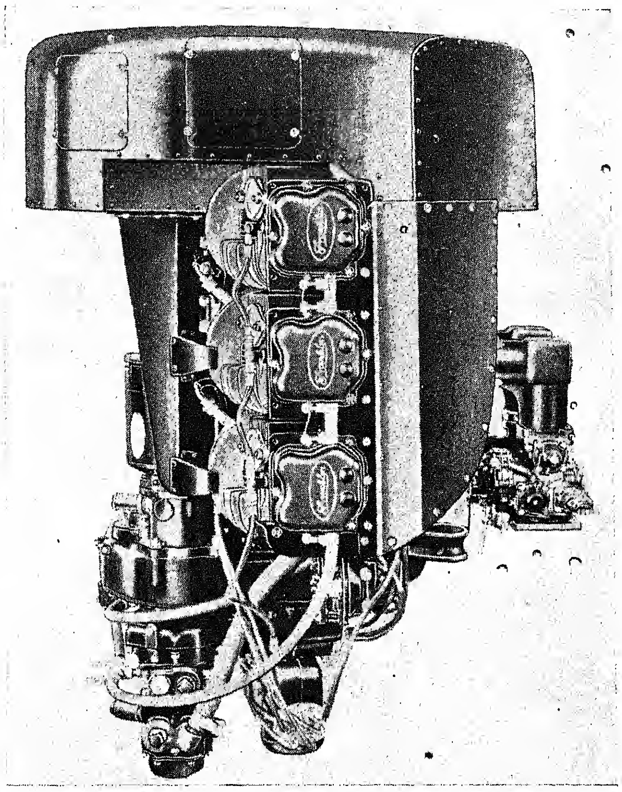
Type.—Six-cylinder horizontally-opposed air-cooled by means of integral fan. Engine operates in vertical position and is designed especially for a helicopter installation.
Cylinders.—Bore $4\frac{1}{2}$ in. (114.3 m/m.), Stroke $3\frac{1}{2}$ in. (88.9 m/m.), Capacity 335 cub. in. (5.5 litres), Compression Ration 7.0 : 1.
Octane No.—80.
Accessories.—Dual magnetos, pressure-type carburettor, 12-volt starter, generator, fuel-pump, oil-cooler, cooling-fan with air housings.
Weight.—310 lbs. (140.7 kg.).
Performance.—Nett rated output : 178 h.p. at 3,000 r.p.m.

THE FRANKLIN 6A8-215-B8F.

Type.—Six-cylinder horizontally-opposed. Air-cooled by means of integral fan. Engine has propeller shaft extension designed for pusher installations.
Cylinders.—Bore 5 in. (127 m/m.), Stroke $4\frac{1}{4}$ in. (108 m/m.), Capacity 500 cub. in. (8.2 litres). Compression ration 7.0 : 1.
Octane No.—80.
Accessories.—Dual magneto/battery ignition, float-type carburettor, 12-volt starter, generator, dual fuel-pumps, oil-cooler, cooling-fan with air housings.
Weight.—485 lbs. (220 kg.) complete.
Performance.—Nett rated output : 215 h.p. at 2,500 r.p.m.

THE FRANKLIN 6ACV-403.

The 6ACV-403 is a helicopter engine which Aircooled Motors, Inc. designed, developed and produced for installation in the Sikorsky R-6 and other military helicopters. It was built solely for military purposes and is no longer in production.
Type.—Six-cylinder horizontally-opposed, air-cooled by means of integral fan. Engine operates in the vertical position and designed especially for a helicopter installation.
Cylinders.—Bore 5 in. (127 m/m.), Stroke $4\frac{1}{4}$ in. (108 m/m.), Capacity 500 cub. in. (8.2 litres), Compression Ratio 7.0 : 1.
Octane No.—80.



The Franklin 6ACV-403 helicopter engine.

Accessories.—Dual magnetos, dual pressure-type carburettors, 24-volt starter, fuel-pump, cooling-fan with air housings.
Weight.—458 lbs. (207.9 kg.) complete.
Performance.—Nett rated output : 235 h.p. at 3,275 r.p.m.

GUIBERSON.

THE GUIBERSON DIESEL ENGINE COMPANY.

Head Office and Works : 1,000, Forest Avenue, Dallas, Texas.

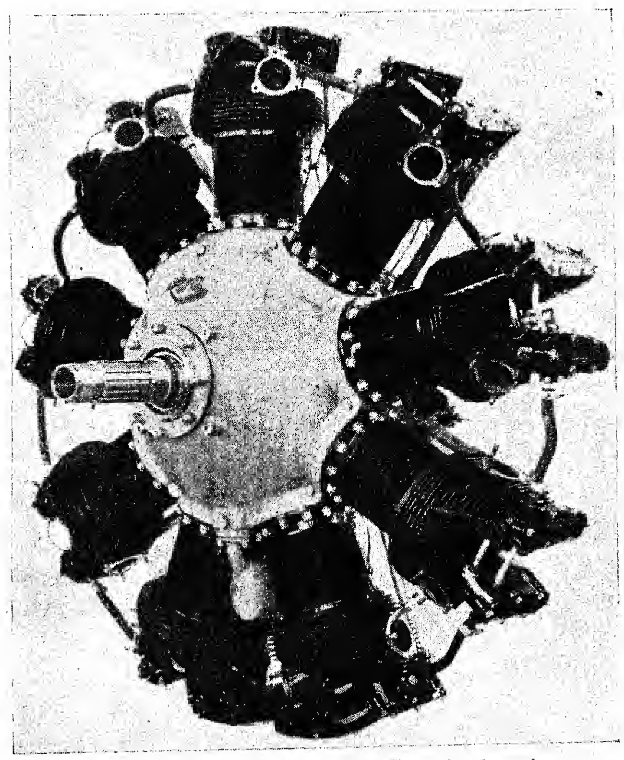
This firm was organized in 1932 to manufacture aero-engines of the Diesel type after the Guiberson Corporation, who are manufacturers of oil industry equipment, had experimented for three years on the principles involved. Their first engine was granted Approved Type Certificate No. 79 by the U.S. Department of Commerce at a rating of 185 h.p.

The Model A-1020 engine, described below, received its A.T.C. No. 220 in February, 1940, and since installation in a Stinson Reliant monoplane has flown over 1,000 hours on test.

The Company has been unable to produce this engine commercially owing to the fact that its full capacity was used to manufacture engines for U.S. Army tanks. The Model T-1020, which is basically similar to the A-1020 aero-engine, was specially designed for tank use and develops 210 h.p. at 2,200 r.p.m. The Model T-1400, produced for medium tank and marine use, develops 250 h.p. at 2,200 r.p.m.

THE GUIBERSON A-1020 DIESEL.

Type.—Nine-cylinder four-cycle Diesel radial.
Cylinders.—Bore 5.125 in. (130.175 m/m.), Stroke 5.5 in. (139.7 m/m.). Capacity 1,021 cub. in. (16.73 litres). Compression ratio 15 : 1. B.M.E.P. for rated output 113 lbs. per sq. in. (7.94 kg./sq. c/m.).
Valve Gear.—One inlet and one exhaust valve per cylinder operated through push-rods and overhead rocker-gear. Combined timing and injection control. Decompression device, controlled by throttle, allows airscrew to turn freely in the air or on ground.
Induction System.—One Guiberson pump per cylinder forces fuel at 2,200 to 2,500 lbs./sq. in. (155 to 276 kg./sq. c/m.) pressure through one Guiberson injector into each cylinder. No super charger.
Starting.—Eclipse electric inertia or Coffman air starter.
Dimensions.—Diameter 47.125 in. (1,198 m/m.), Length (including starter) 38.6 in. (976 m/m.).
Weight.—653 lbs. (296.4 kg.).
Performance.—Rated 310 h.p. at 2,150 r.p.m. at sea level, Fuel consumption Diesel Index No. 50 .382 lb. (. 181 kg.) per h.p. hour. Oil consumption .02 lb. (.009 kg.) per h.p. hour



The Guiberson A-1020 nine-cylinder Diesel engine.

JACK & HEINZ.

JACK & HEINZ, INC.

Head Office and Works : Cleveland 1, Ohio.

Well-known as designers and manufacturers of auxiliary power-plants, engine starters, automatic pilots, generators, flight instruments, etc., Jack & Heinz, Inc. is now engaged in the development of a six-cylinder horizontally-opposed air-cooled aero-engine as part of its new die-cast engine programme. Other units in this programme include a six-cylinder automobile engine and four and two-cylinder auxiliary power-plants, all of which will have a wide range of interchangeability of components and parts.

JACK & HEINZ—*continued.*

The aero-engine consists essentially of six main aluminium or magnesium die castings, *i.e.* crankcase, including cylinder barrels; cylinder head; oil pan; accessory cover; and front and rear covers. The engine will have a displacement of 126 cub. in. (2.06 litres) and outputs of 95 h.p. maximum and 75 h.p. rated power. It will weigh approximately 200 lbs. (91 kg.). No further details are available.

JACOBS.

THE JACOBS AIRCRAFT ENGINE COMPANY (DIVISION OF REPUBLIC INDUSTRIES, INC.).

Head Office and Works: Pottstown, Pennsylvania.
General Manager: H. B. Knerr.
Director of Engineering and Sales: Albert R. Jacobs.

The Jacobs Aircraft Engine Company has been concentrating on the production of two basic radial air-cooled engines, the R-775 and R-915.

The Jacobs R-755 Series are unsupercharged conservatively-rated engines, featuring simplicity of design. The absence of high cylinder pressures, combined with large bearing areas and rating at moderate r.p.m. permit operations at a high proportion of the rated power for extended periods without damage. This engine has been used to power a major percentage of the United Nations twin-engined trainers. In military training operation it has proved its reliability under the most severe conditions and is operating up to 1,200 hours between overhauls.

The Jacobs R-915 Series engines are also unsupercharged conservatively-rated engines of increased bore and stroke. Construction is similar to the R-755 engines except that many parts have been strengthened to absorb the increased horse-power. In spite of the unusually ample displacement and conservative rating, the power/weight ratio of the R-915A engine is only 1.68 lbs./h.p. (0.76 kg./h.p.).

The Jacobs Aircraft Engine Company has also introduced a series of four and six-cylinder liquid-cooled horizontally-opposed engines for the light commercial market.

THE JACOBS R-755A1.

Type.—Seven-cylinder air-cooled radial.

Cylinders.—Bore 5.25 in. (133 m/m.), Stroke 5 in. (127 m/m.,) Capacity 757 cub. in. (12.4 litres). Barrels machined from steel forging with closely-spaced fins. Aluminium-alloy heads screwed and shrunk on. Aluminium-bronze valve-seats shrunk into heads.

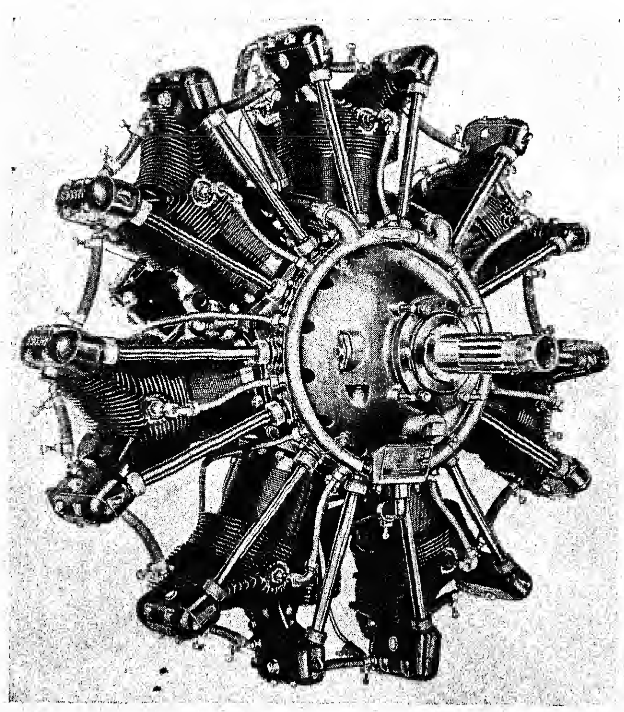
Pistons.—Forged aluminium-alloy. Three compression rings above gudgeon pin and one scraper ring below. Fully-floating, nitrided gudgeon pins.

Connecting Rods.—One-piece steel master-rod and forged aluminium-alloy link-rods, the aluminium bearing directly on nitrided steel pins.

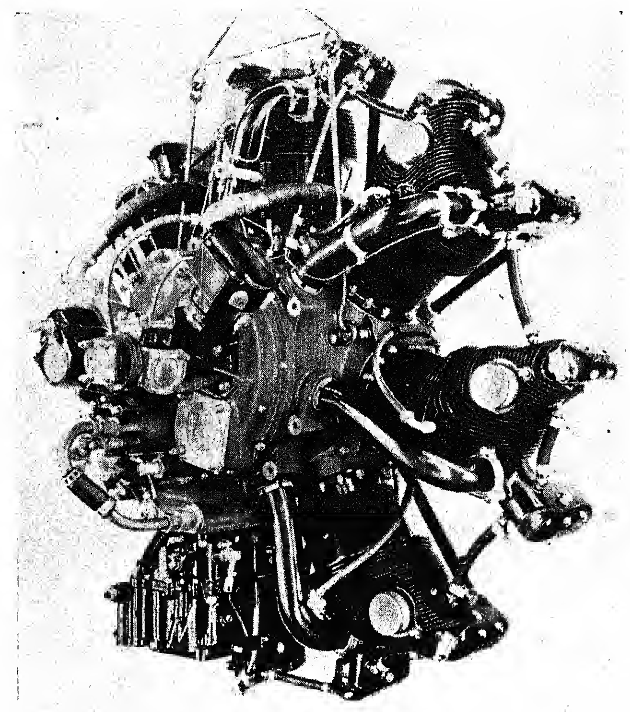
Crankshaft.—Two-piece clamp type, made from chrome-nickel molybdenum steel forgings.

Crankcase.—Built up of five parts. First, magnesium-alloy front case carrying the thrust ball-bearing and valve-operating gear; second, front half of main crankcase, aluminium-alloy casting which supports the front crankshaft roller-bearing; third, rear half of main crankcase, magnesium-alloy casting, which supports the rear crankshaft roller-bearing and incorporates a ring-type intake manifold; fourth, magnesium-alloy rear plate, which carries additional crankshaft ball-bearing and supports accessory drives; magnesium-alloy rear case, which carries accessories.

Valve Gear.—The whole valve gear (cam, drive gears, tappets and push-rods) is in the nose section. All moving parts enclosed.



The 300 h.p. Jacobs R-755A1 radial air-cooled engine.



The 375 h.p. Jacobs R-915A1 radial air-cooled engine.

Tulip-type inlet valves, and sodium-cooled exhaust valves. Two springs per valve.

Carburation.—A single Stromberg NA-R7A carburettor.

Ignition.—One Scintilla magneto and one Scintilla battery distributor, incorporating automatic spark advance.

Lubrication.—One pressure and two scavenger pumps, of gear type, built into one unit. Dry sump. Pressure to all main bearings. A take-off to operate an adjustable-pitch or constant-speed airscrew can be incorporated. Automatic valve lubrication is standard equipment.

Fuel.—80 octane.

Airscrew Drive.—R.H. tractor. Direct. No. 20 SAE spline.

Dimensions.—Diameter 44 in. (1,118 m/m.), Length (to rear of mounting plate) 27¼ in. (692 m/m.), Overall length 40$\frac{5}{32}$ in. (1,020 m/m.).

Weight.—505 lbs. (229 kg.).

Performance.—Take-off rating 300 h.p. at 2,200 r.p.m., Rated output 225 h.p. at 2,000 r.p.m.

THE JACOBS R-755A3.

This engine is similar to the R-755A1 except that ignition is from two Scintilla magnetos. Provision is made for mounting an electrical generator and direct cranking electric starter.

THE JACOBS R-915A1.

Except where stated, the construction of the R-915A1 is as for the R-755A1 but dimensions are increased and stressed parts strengthened.

Type.—Seven-cylinder air-cooled radial.

Cylinders.—Bore 5½ in. (139.7 m/m.), Stroke 5½ in. (139.7 m/m.). Capacity 914 cub. in. (14.97 litres). Compression ratio 6 : 1.

Pistons.—Forged aluminium-alloy, waffle-head design.

Connecting Rods.—Link-rods are of forged chrome-molybdenum steel. Bronze bushes for gudgeon pin and knuckle pin bearings.

Carburettor.—Stromberg NA-R7A.

Ignition.—One Scintilla magneto and one Scintilla battery distributor incorporating automatic spark advance. Eclipse 25-amp. generator.

Airscrew Drive.—R.H. tractor. Direct drive. S.A.E. No. 20 spline.

Dimensions.—Diameter 45⅝ in. (1,160 m/m.), Length 40$\frac{9}{16}$ in. (1,030 m/m.), Diameter of mounting bolt (8 × ⅜ in.) circle 16½ in. (419.1 m/m.).

Weight (including magneto, battery distributor, coil, radio shielding carburettor, automatic valve lubrication and oil strainer).—555 lbs. (252 kg.).

Performance.—Take-off rating 375 h.p. at 2,300 r.p.m., Rated output 300 h.p. at 2,100 r.p.m., Cruising 220 h.p. at 1,900 r.p.m.

THE JACOBS R-915A3.

This engine is similar to the R-915A1 except that ignition is supplied by two Scintilla magnetos. Weight 557 lbs. (253 kg.).

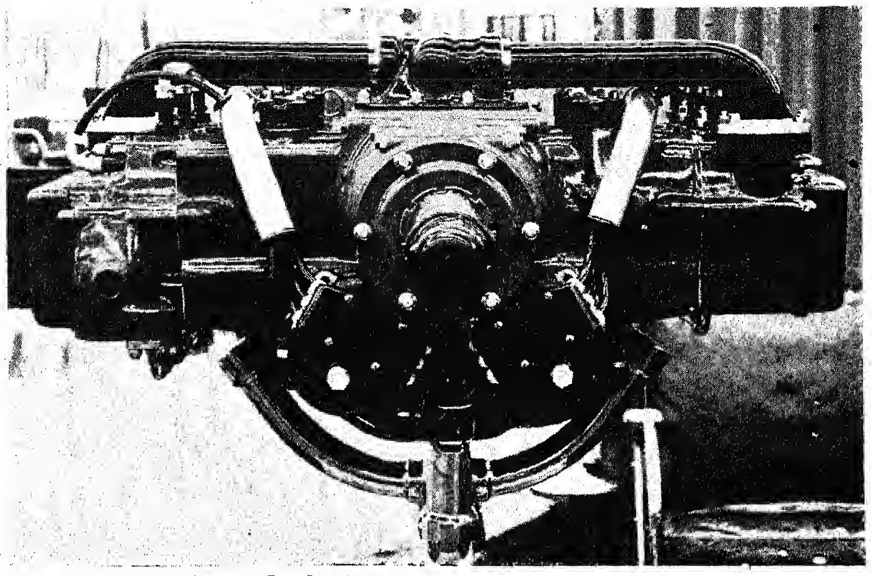
THE JACOBS R-915A4.

This engine is similar to the R-915A1 except that a power drive is supplied for a helicopter rotor.

JACOBS—continued.

THE JACOBS OPPOSED ENGINES.

The Jacobs company has announced a new series of horizontally-opposed engines which will be available in both air and liquid-cooled forms. Four engines will be available, the 100 h.p. O-240A air-cooled and O-240L liquid-cooled, and the 165 h.p. O-360A air-cooled and O-360L liquid-cooled. The air-cooled engines will employ reverse cooling and the liquid-cooled models high-velocity negative-drag type buried radiators. The first of these engines, the O-360L six-cylinder liquid-cooled unit, was exhibited at the National Aircraft Show held in Cleveland in November, 1946.



The 165 h.p. Jacobs O-360L six-cylinder liquid-cooled engine.

THE JACOBS O-360L

Type.—Six-cylinder horizontally-opposed liquid-cooled.
Cylinders.—Bore 4.375 in. (111 m/m.), Stroke 4 in. (91.6 m/m.), Capacity 361 cub. in. (5.9 litres). Compression ratio 6.5 : 1.
Valve Gear.—Dual camshafts with overhead valves and hydraulic valve lifters.
Fuel System.—Direct fuel-injection using Ex-Cell-O injection pump.
Fuel Grade.—80 Octane.
Ignition.—Bendix-Scintilla magneto-battery system or dual magnetos mounted forward of the engine beneath the extended nose case. Two shielded sparking-plugs per cylinder.
Cooling.—Ethylene-glycol/water. Provision for high-velocity negative-drag buried coolant radiator.
Lubrication.—Wet-sump integral with crankcase.
Mounting.—Three-point suspension using conical sandwich rubber mounts.
Starter.—Delco-Remy electric direct-cranking. Ratio 32.6 : 1.
Generator.—Delco-Remy 12-volt 25-amp.
Dimensions.—Overall width 32.5 in. (0.825 m.), Overall height 17.47 in. (0.443 m.). Overall length 47.64 in. (1.210 m.).
Weights.—Average dry weight (estimated) 345 lbs. (156.6 kg.), Weight of generator plus starter 31.8 lbs. (14.4 kg.) or weight of Breeze starter-generator combination 25 lbs. (11.35 kg.).
Performance.—Take-off and rated power 165 h.p. at 2,400 r.p.m. at sea level.

KINNER.

GLADDEN PRODUCTS CORPORATION (Formerly Kinner Motors Inc.).

Head Office: 635, West Colorado Boulevard, Glendale 4, California.

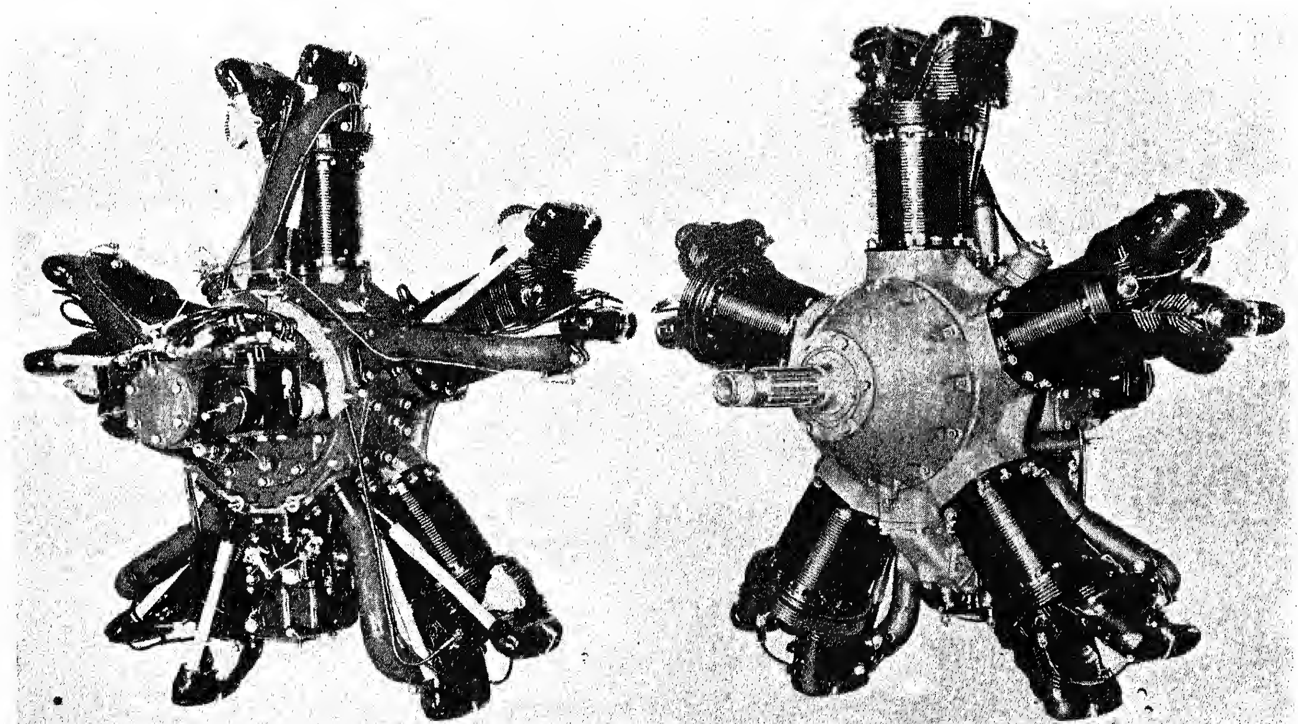
President and General Manager: John N. Gladden.
Vice-President: G. Brashears.
Secretary and Treasurer: J. Murray Wilson.
Sales Manager: William P. Stratton, Jr.

Kinner Motors, Inc. succeeded the former Kinner Airplane & Motor Corpn. in 1939 and in September, 1945, the name of the company was changed to Gladden Motors Corpn.

Production of the company has been principally devoted to three models, the 125 h.p. B-54, the 160 h.p. R-55 and the 160 h.p. R-56. While a large percentage has gone into military service, the company has been able to supply commercial users with many of their requirements.

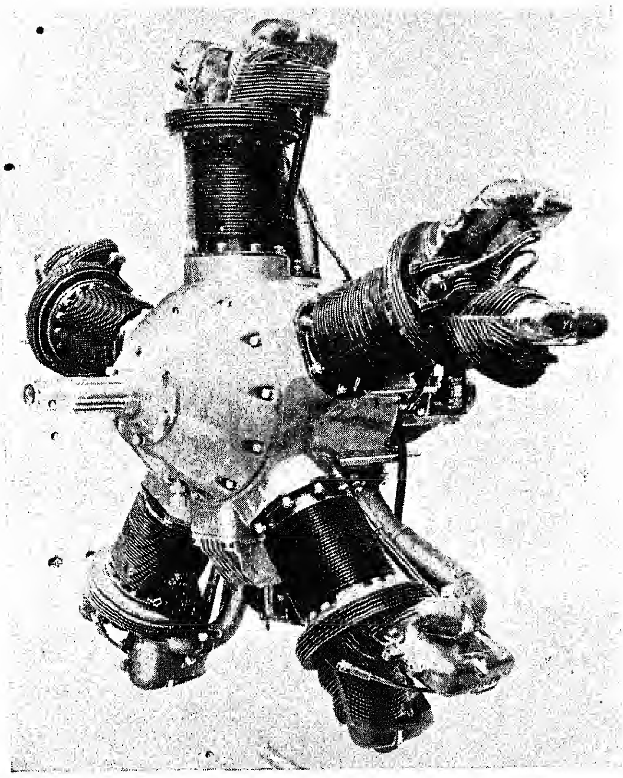
THE KINNER K-5 SERIES II.

Type.—Five-cylinder air-cooled radial.
Cylinders.—Bore 4¼ in. (108 m/m.), Stroke 5¼ in. (133.5 m/m.). Swept volume 372 cub. in. (6.1 litres). Compression ratio 5 : 1. Forged steel barrel bolted to crankcase, has aluminium-alloy head secured by 16 studs. Bronze valve-seats shrunk and rolled in.
Pistons.—Aluminium-alloy trunk type. Three compression rings and one scraper ring above fully-floating gudgeon pin, which is located by aluminium end plugs.
Connecting Rods.—Heat-treated alloy-steel forgings. Split master big-end, H-section auxiliary rods.
Crankshaft.—One-piece heat-treated and ground alloy-steel forging, carefully counterbalanced, runs in plain babbit bearings and thrust taken by a ball bearing.



The 160 h.p. Kinner R-55 five-cylinder radial air-cooled engine.

KINNER—continued.



The 125 h.p. Kinner B-54 five-cylinder radial engine.

Valve Gear.—One inlet and one exhaust valve per cylinder operated through rockers and push-rods and roller cam-followers off five separate camshafts driven at ½ engine speed.
Carburation.—Stromberg Model NAR5A or Holley Model 419 carburettor.
Ignition.—Two Bendix Scintilla magnetos. Battery ignition also offered.
Lubrication.—High pressure. Pressure pump at 100 lbs./sq. in. (7.03 kg./sq. c/m.) feeds through crankshaft to main and connecting-rod bearings. Separate scavenge pump.
Airscrew Drive.—Direct. SAE No. 20 spline.
Dimensions.—Diameter 45⅜ in. (1,153 m/m.), Length 31½ in. (800 m/m.), Mounting bolt circle 14 in. (35 6 m/m.).
Weights.—Dry, without carburettor air heater, exhaust collector ring, starter or propeller hub nut, 304 lbs. (137 kg.).
Performance.—Rated output 100 h.p. at 1,810 r.p.m.

THE KINNER B-5 AND B-54.

Type.—Five-cylinder air-cooled radial.
Cylinders.—Bore 4⅝ in. (117.5 m/m.), Stroke 5¼ in. (133.5 m/m.). Swept volume 441 cub. in. (7.2 litres). Compression ratio 5.25/1. Other details as for K-5.
Pistons.—Aluminium-alloy trunk type. Three compression rings and one scraper ring above fully-floating gudgoon pin, which is retained by aluminium end plugs.
Connecting Rods.—Split master big-end and H-section auxiliary rods.
Crankshaft.—Counterbalanced single-throw one-piece alloy-steel shaft runs in plain bearings, with single-row radial thrust-bearing.
Crankcase.—Barrel type aluminium-alloy, of normal design.
Valve Gear.—Five separate camshafts drivon at half engine speed, with normal type cams, followors and tappets. Enclosed overhead rocker-arms actuated by push-rods.
Carburation.—One Holley or Stromberg carburettor.
Ignition.—Two Bendix Scintilla magnetos driven off the roar end of the crankshaft by spur wheels.
Lubrication.—Circulating dry sump system. Pressure feed.
Accessories.—Drives and mountings for the usual accessories.
Airscrew Drive.—Direct No. 1 spline on B5, SAE No. 10 on B-54.
Dimensions.—Diameter overall 45⅜ in. (1,153 m/m.), Length overall 31½ in. (800 m/m.).
Weight Dry (without air-heater, exhaust collector ring, starter or airscrew hub).—312 lbs. (142 kg.).
Performance.—Rated output 125 h.p. at 1,925 r.p.m., Consumptions per h.p. hour: Fuel .60 lb. (.273 kg.); Oil (Max.) .02 lb. (0.011 kg.).

THE KINNER R-5 SERIES II AND R-55.

The construction of the Kinner R5 Series II is practically the same as the B-5. All oil passages in the R5 Series II, however, are contained within the crankcase.

The main difference between the R-55 and the R-5 Series II is that the former has an SAE No. 20 spline shaft whereas the R-5 has a No. 1 taper shaft.

Cylinders.—Bore 5 in. (128 m/m.), Stroke 5½ in. (140 m/m.), Swept volume 540 cub. in. (8.85 litres). Compression ratio 5.5 : 1.
Weight Dry (without airscrew hub, air-heater, exhaust collector ring, starter, generator or fuel pump)—R-5 Sories II, 335 lbs. (152 kg.), R-55, 345 lbs. (156 kg.).
Dimensions.—Diameter overall 45⅝ in. (1,159 m/m.), Length overall R-5 Series II 31$\frac{15}{32}$ in. (800 m/m.), R-55 33⅝ in. (853 m/m.).
Performance.—Rated output 160 h.p. at 1,850 r.p.m.

THE KINNER R-53.

The R-53 is similar to the R-55 but develops a greater output by a slight increase in compression ratio and r.p.m. Its mounting dimensions are identical to those of the B-54 and R-55, it is interchangeable with the R-55 and can be substituted for the B-54 with only slight installation alterations.

Weight Dry.—351 lbs. (159.3 kg.).
Dimensions.—As R-55.
Performance.—Rated output 175 h.p. at 2,100 r.p.m.

THE KINNER R-56.

Type.—Five-cylinder air-cooled radial.
Cylinders.—Bore 5 in. (128 m/m.), Stroke 5.5 in. (140 m/m.), Swopt volumo 540 cub. in. (8.85 litres), Compression ratio 5.5 : 1. Forged steol barrels and cast aluminium-alloy heads bolted together. Valve-seat inserts of special bronzo pressed and rolled into place. Rocker-arm supports cast integrally with head.
Pistons.—Aluminium-alloy trunk-type. Three compression rings and one scraper ring all located above tho gudgeon-pin.
Connecting Rods.—Articulated type H-section. Master-rod fitted with steel-backed copper-lead bearing.
Crankshaft.—One-piece forged steel shaft with dynamic damper counterweights, supported on a roller front main bearing, a ball thrust bearing and a sleeve type steel-backed rear main bearing.
Crankcase.—Barrel type of cast aluminium-alloy. Front cover carries front crankshaft bearings, rear wall supports rear crank-shaft bearing and bearings for five camshafts. Rear case includes cast aluminium manifold from which intake pipes radiate to cylinder heads and supports auxiliaries.
Valve Gear.—Two valves per cylinder operated by enclosed push-rods and rocker arms from individual camshafts at the rear of cylinders.
Carburation.—One Holley or Stromberg carburettor.
Lubrication.—Dry sump, with pressure lubrication to rocker boxes, etc. Gear type pressuro and scavenge pumps.
Accessories.—Drives and mountings on rear crankcase cover.
Dimensions.—Diameter overall 45⅝ in. (1,153 m/m.), Length overall 33$\frac{1}{32}$ in. (853 m/m.).
Weight Dry (without air-heater, exhaust collector ring, startor or airscrew hub).—362 lbs. (164.3 kg.).
Performance.—Rated output 160 h.p. at 1,850 r.p.m.

LYCOMING.

THE LYCOMING DIVISION OF THE AVIATION CORPORATION.

Head Office: 420, Lexington Avenue, New York, N.Y.
Production and Sales Offices: Williamsport, Penna.
President: I. B. Babcock.
Executive Vice-President: William F. Wise.
Vice-President, Secretary and General Counsel: R. S. Pruitt.
Vice-President and Treasurer: W. A. Morgensen.
Vice-President in charge of Manufacturing: C. H. Kindl.
Vice-Presidents: L. I. Hartmeyer and I. J. Snader.
Chief Engineer: C. H. Wiegman.
General Manager: G. G. Johnson.
Sales Manager: R. E. Posthauer.

The Lycoming Division is the aero-engine and airscrew manufacturing division of The Aviation Corporation which on January 1, 1936, acquired the assets and manufacturing rights of the Aviation Division of Lycoming Manufacturing Company, Williamsport, Penna.

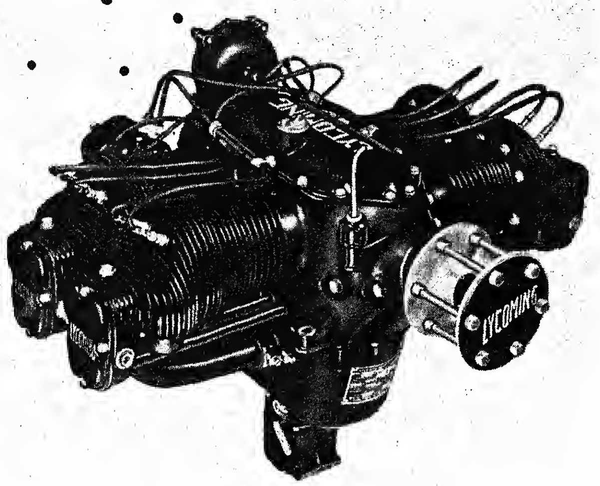
The first aero-engine was developed by Lycoming in 1928 and was the nine-cylinder Model R-680, development of which was begun the same year. The first production model (215 h.p.) was delivered early in 1931. The R-680 engine, produced throughout the war, is no longer in production.

Manufacture of the horizontally-opposed air-cooled series was started in 1938 with a 50 h.p. model. This series of engines now includes six basic models—four four-cylinder and two six-cylinder—which constitute the 1946 Lycoming production programme. These engines are described and illustrated hereafter.

The adaptability of the Lycoming flat engine was well demonstrated during the war by the O-435 engine, which formed the power-plant of the Stinson L-5 Sentinel liaison-observation and ambulance monoplane, the Sikorsky R-6 helicopter and the Locust airborne tank.

Since 1932 the Company has been engaged in the development of high-output aero-engine cylinders. The first single-cylinder liquid-cooled engine completed a 50-hour test in May, 1936. It was followed in December, 1937, by a 1,000/1,200 h.p. twelve-cylinder horizontally-opposed liquid-cooled engine of 1,233.6 cub. in. (20.2 litres) displacement. In July, 1940, the XH-2470 H-type engine developing 2,000/2,400 h.p. was completed, and in 1943 design of a thirty-six cylinder four-row radial liquid-cooled engine was initiated. This engine, the XR-7755, is the most powerful reciprocating aero-engine yet developed, and has a maximum take-off output of 5,000 h.p. It was completed in July, 1946.

***LYCOMING**—continued.*



The 65 h.p. Lycoming O-145 series engine.

THE LYCOMING O-145.

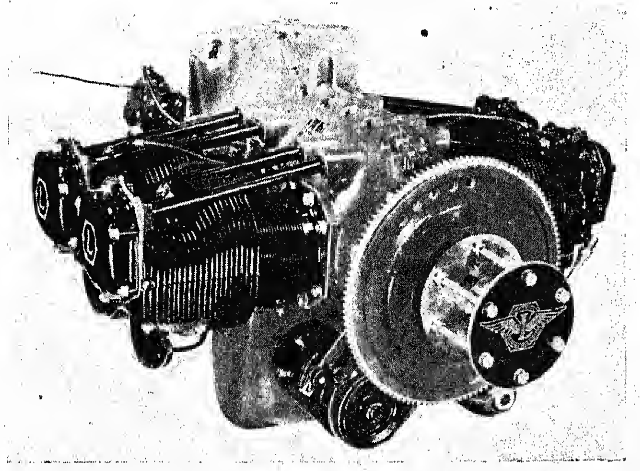
Type.—Four-cylinder horizontally-opposed air-cooled.

Cylinders.—Bore $3\frac{5}{8}$ in. (92 m/m.), Stroke $3\frac{1}{2}$ in. (89 m/m.). Capacity 144.5 cub. in. (2.37 litres). Two cylinders integral with each half of cast semi-steel crankcase. Cylinder cooling fins cast directly on barrels. Cast aluminium heads attached to cylinders by studs and nuts. Cylinder heads are furnished with Helicoil inserts into which the sparking-plugs are screwed.

Pistons.—Aluminium-alloy pistons with two compression rings, one oil-regulating ring and one oil scraper ring. Full-floating gudgeon pins with aluminium-alloy retaining plugs each end.

Connecting Rods.—Forged steel H-section rods. Bronze bushing in piston end and split copper-lead steel-backed bearing at crankpin end.

Crankshaft.—One-piece forged alloy-steel shaft with four throws and three main bearings. Drilled throughout for lightness and oil passages. Spur gear to drive camshaft attached to rear of shaft with dowels and capscrews. On direct-drive models airscrew hub flange is forged integral with crankshaft. On geared models reduction gear and airscrew hub rear flange forged integral with



The 100 h.p. Lycoming O-235-C four-cylinder engine.

steel airscrew shaft supported by two replaceable steel-backed lead-bronze-lined bearings. Airscrew shaft driven by gear attached to crankshaft by keyway and nut threaded on crankshaft.

Crankcase.—Integral crankcase and cylinder block split vertically and held together by studs, nuts and capscrews. Internal webbing support camshaft bearings and three replaceable steel-backed copper-lead main bearings.

Valve Gear.—Heat-treated alloy-steel camshaft with hardened lobes drilled for lightness and to provide oil passages. Mushroom type steel cam-followers with hardened faces and sockets operate directly in crankcase sections. Push-rods of steel tubing with hardened ball ends. Forged steel rocker-arms supported on full-floating pins in cylinder-head and secured by end-plugs. One inlet and one exhaust valve per cylinder may be adjusted by screw and locknut in rocker-arms. Single valve-springs secured with tapered collars and split-type valve-keys.

Induction.—Marvel Model MA-2 single-barrel carburettor attached to bottom of oil sump. Centre-zone induction system, cast directly in oil sump, is submerged in heated engine oil to insure thorough and uniform vaporisation of fuel. Each cylinder has interchangeable steel intake pipe attached at both ends with rubber sleeves and clamps.

Ignition.—Dual Scintilla magnetos driven by spur gear from camshaft.

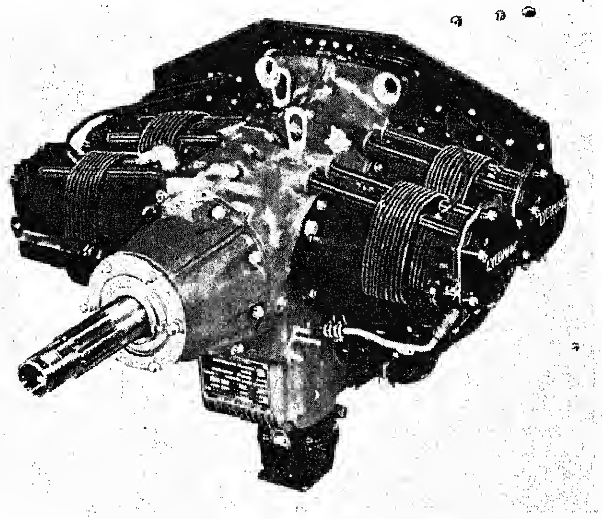
Lubrication.—Full-pressure type except for valve mechanism which is lubricated by gravity-fed engine oil. Oil is forced by pressure pump through camshaft to all cam bearings, crankshaft main bearings and connecting-rod bearings. Crankshaft is bored to provide centrifugal sludge removers at all passages leading to the main and connecting-rod bearings. Pistons, gudgeon pins and accessory drive gears are lubricated by splash. Screen oil-baffle provided between crank-case and oil sump which has a capacity for 1 U.S. gallon (3.758 litres) of oil.

Accessories.—On all standard O-145 models accessory housing incorporates pressure oil pump, oil relief valve, and tachometer connection. The oil pump and tachometer shafts are driven directly from the camshaft. On O-145-A3 and O-145-B3 provision is made for the installation of an aircraft type generator and starter. The starter jaw is located directly at the rear of the crankshaft, the generator is directly above the starter and is driven through a spur gear and idler gear by the crankshaft ; a pump of the plunger type is driven by an eccentric located on the oil pump shaft.

Dimension and Weights.—See Table.

THE LYCOMING O-235-C.

This engine, which is rated at 100 h.p., is identical to the 0-290 except that the bore is decreased from $4\frac{7}{8}$ in. (123.7 m/m.) to $4\frac{3}{8}$ in. (111 m/m.), the displacement being correspondingly decreased. For structural details see description of the O-290 and for specifications see Table.



The 125 h.p. Lycoming GO-290A engine.

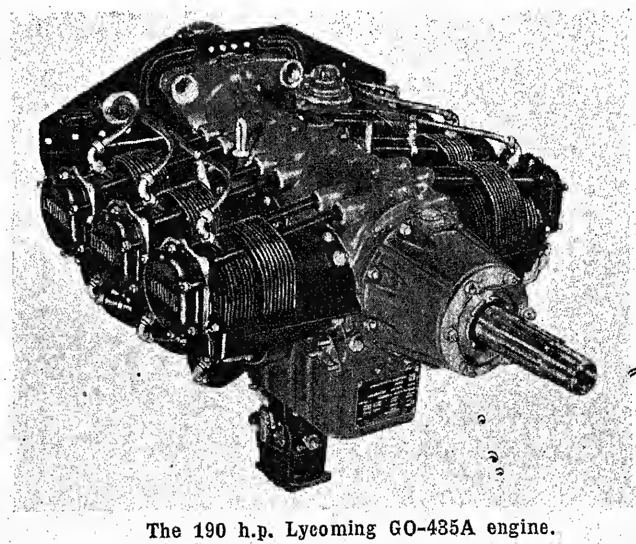
THE LYCOMING O-290 AND O-435 SERIES.

Type.—Four-cylinder (O-290) or six-cylinder O-435) horizontally-opposed air-cooled incorporating the same major components.

Cylinders.—Bore $4\frac{7}{8}$ in. (123.7 m/m.), Stroke $3\frac{7}{8}$ in. (98.4 m/m.). Aluminium-alloy heads screwed and shrunk on to steel barrels. Cylinder assemblies attached to crankcase by studs and nuts. Two aluminium-bronze spark-plug bushings screwed and shrunk into heads on opposite sides.

Pistons.—Aluminium-alloy pistons with two compression and two oil control rings. Fully floating gudgeon-pins with aluminium-alloy retaining plugs.

Crankcase.—Aluminium-alloy casting split on the vertical centre-line. Four copper-lead steel-backed main bearings on the four-cylinder model. Additional ball-thrust bearing at forward end of case on the six-cylinder model. Halves of case secured by studs and nuts.



The 190 h.p. Lycoming GO-435A engine.

LYCOMING—*continued.*

LYCOMING HORIZONTALLY-OPPOSED ENGINES.

Engine Model	No. of Cylinders	Rated output at Sea level	Capacity	Compression Ratio	Octane No.	Weight Dry	Overall Length	Overall Width	Overall Height	Gear Ratio
O-145-B	4	65 h.p. at 2,550 r.p.m.	145 cub. in. (2.37 litres)	6.5 : 1	73 or 80/85	163.4 lb. (74.2 kg.)	24.62 in. (.625 m/m.)	29.56 in. (750 m/m.)	20.59 in. 518 m/m.)	Direct
O-235-C	4	100 h.p. at 2,600 r.p.m.	233 cub. in. (3.85 litres)	6.5 : 1	73 or 80/85	207 lb. (93.9 kg.)	29.56 in. (751 m/m.)	32.08 in. (821 m/m.)	22.53 in. (570 m/m.)	Direct
O-290-A	4	125 h.p. at 2,600 r.p.m.	289 cub. in. (3.85 litres)	6.5 : 1	73 or 80/85	244.2 lb. (110.8 kg.)	31.54 in. (802 m/m.)	32.32 in. (821 m/m.)	26.64 in. (677 m/m.)	Direct
GO-290-A	4	160 h.p. at 3,000 r.p.m.	289 cub. in. (4.75 litres)	7.5 : 1	91/98	350 lb. (158.9 kg.)	49.00 in. (1,244 m/m.)	33.30 in. (846 m/m.)	29.61 in. (677 m/m.)	77 : 120
O-435-A	6	190 h.p. at 2,550 r.p.m.	434 cub. in. (7.1 litres)	6.5 : 1	73 or 80/85	(363.92 lb. (165.2 kg.)	46.36 in. (1,177 m/m.)	32.24 in. (817 m/m.)	28.59 in. (726 m/m.)	Direct Drive
GO-435-A	6	240 h.p. at 3,000 r.p.m.	434 cub. in. (7.1 litres)	7.5 : 1	91/98	(435 lb. (198 kg.)	47.70 in. (1,232 m/m.)	33.30 in. (846 m/m.)	29.61 in. (752 m/m.)	77 : 120
*O-435-D	6	225 h.p. at 2,550 r.p.m.	434 cub. in. (7.1 litres)	7.5 : 1	100	433 lb. (196.58 kg.)	43.50 in. (1,105 m/m.)	33.50 in. (824 m/m.)	30.00 in. (762 m/m.) minimum	—

* Crankshaft in vertical plane for helicopter installation.

INDUCTION.—Marvel-Schebler single barrel carburettor attached to bottom of oil sump casting. The distributing zone is submerged in oil. Separate induction pipes lead to inlet valves.

IGNITION.—Dual Scintilla magnetos driven by spur gears from the timing gear.

LUBRICATION.—Full pressure type, including valve mechanism. Crankshaft equipped with centrifugal sludge-removers. Pistons, gudgeon pins and accessory drive gears lubricated by splash. Sump capacity (O-290) 2 U.S. gallons (7.516 litres) and (O-435) 3 U.S. gallons (11.355 litres).

ACCESSORIES.—Drive for dual magneto, starter, generator and single tachometer are standard. In addition drives for fuel pump, vacuum pump, generator and dual tachometers can be supplied.

DIMENSIONS AND WEIGHTS.—See Table.

LYCOMING HELICOPTER ENGINES.

Lycoming opposed air-cooled engines for use in helicopters are arranged to be mounted with the crankshaft in a vertical plane. The standard AN splined drive-shaft is replaced with a flange for close-coupled attachment to the free-wheeling device or clutch.

As a helicopter operates without any particular velocity relative to the surrounding air it is necessary to provide a power-driven cooling-fan. Lycoming engines are equipped with an axial-flow fan mounted on the upper end of the crankshaft with diffuser-vanes below the fan. Cowling is provided to direct the air flow around the cylinders for proper cooling and through a duct to an oil cooler.

Owing to height limitations the six-cylinder engines are operated dry sump. The accessories are mounted radially and the bottom of the accessory housing provides a small sump for the scavenge pump.

The four-cylinder engines being shorter are arranged with a wet sump below the accessory housing. The accessories are arranged parallel with the crankshaft centre-line.

The induction system is disposed on the side of the engine opposite the cooling air cowling for use with a vertical carburettor.

The particulars in the Table relate to the O-435-D engine which forms the power-plant of the Sikorsky R-6 helicopter. This engine is no longer in production.

THE LYCOMING S-580.

The S-580 is a new eight-cylinder horizontally-opposed supercharged engine, four of which will be installed in the Beechcraft Model 34 feeder-line transport. The engine will have a take-off rating of 375 h.p. at 3,400 r.p.m. but no other details were available at the time of closing down for press.

THE LYCOMING XR-7755.

The XR-7755 is a thirty-six cylinder four-row radial liquid-cooled engine developed jointly by the A.A.F. and the Lycomng company, and is the most powerful reciprocating aero-engine yet produced. It has a maximum take-off output of 5,000 h.p. It was completed in July, 1946, having been developed as a result of experience with the A.A.F. Lycoming XH-2470, a twenty-four cylinder H-type liquid-cooled engine rated at 2,400 for take-off which was installed experimentally in the Consolidated Vultee XP-54 fighter. The following particulars of the XR-7755 have been made available for publication.

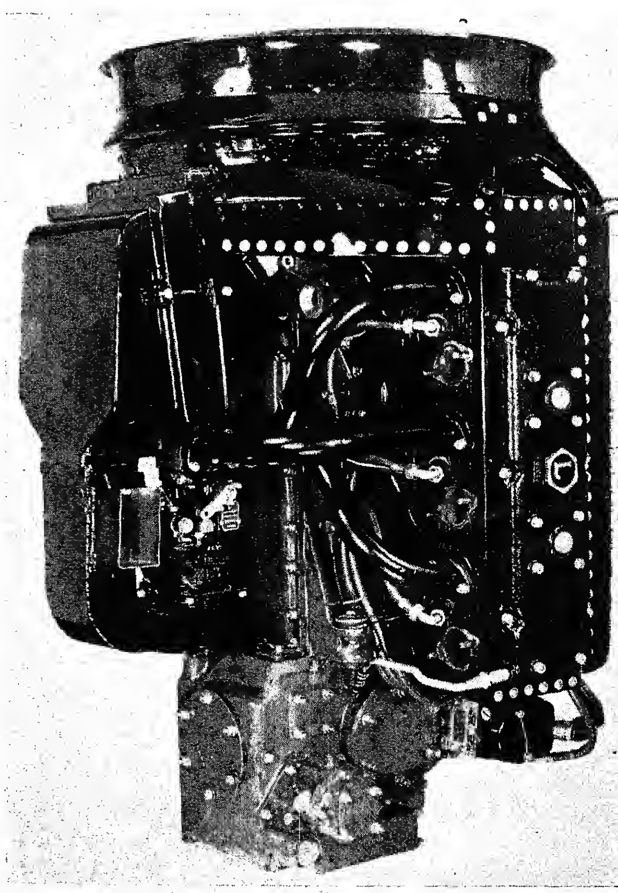
CYLINDERS.—Bore 6.375 in. (161.8 m/m.), Stroke 6.750 in. (171.3 m/m.), Total capacty 7,755 cub. in. (1,264 litres).

CARBURATION.—Either carburation or fuel injection.

IGNITION.—Two Bendix DRN-7 low-tension magnetos.

SUPERCHARGER.—Impellor diameter 14.4 in. (366 m/m.), Impeller ratio 6 : 1.

LUBRICATION.—Oil pressure pump capacity 500 lbs. (227 kg.) per minute; outlet pressure, over 100 lbs./sq. in. (7.03 kg./sq. c/m.).



The 212 h.p. Lycoming O-435-D helicopter engine.

AIRSCREW DRIVE.—Contra rotating co-axial airscrew shaft; inboard rotating counter-clockwise and outboard clockwise. Airscrew shaft spline 601-80. Airscrew drive is through two-speed dual-rotation reduction gear (high ratio 0.2460 ; low ratio 0.3536), either of which can be used to obtain maximum airscrew efficiency. The shifting is accomplished hydraulically and provides a direct drive to each of the two airscrew shafts without the use of a friction clutch. Two separate sets of cams can be shifted to change the valve timing for maximum power or cruising economy, and the ignition timing is also adjustable and is operated by the same mechanism that shifts the camshafts.

ACCESSORY DRIVES.—Generator, power take-off, two vacuum pumps, and fuel pump drives at rear of engine, others including two starters two tachometers and airscrew governor, magnetos and distributors, ahead of front row of cylinders.

DIMENSIONS.—Diameter 61 in. (1,549 m/m.), Length 121.35 in. (3,082 m/m.), Width 60.50 in. (1,537 m/m.), Height 61 in. (1,549 m/m.).

DRY WEIGHT.—6,050 lbs. (2,744 kg.).

PERFORMANCE.—Normal rated power 4,000 h.p. at 2,300 r.p.m., Take-off power 5,000 h.p. at 2,600 r.p.m.

CONSUMPTION (Approximate).—580 U.S. gallons (2,195 litres) per hour.

NELSON.

NELSON SPECIALITY WELDING EQUIPMENT COMPANY.

HEAD OFFICE AND WORKS: SAN LEANDRO, CALIFORNIA.

This Company is building the small four-cylinder horizontally-opposed two-stroke engine which forms the power-plant of the Nelson Dragonfly powered-sailplane.

This engine, which has been designed by Mr. Ted Nelson, is built largely of magnesium and for an output of 25 h.p. at 4,000 r.p.m. has a net weight of under 40 lbs. (18.16 kg.). The cylinders of the engine are magnesium die castings with cast steel sleeves.

Details of the Dragonfly powered-sailplane will be found under "Nelson" (U.S.A.) in Section C.

PACKARD.

THE AIRCRAFT ENGINE DIVISION OF THE PACKARD MOTOR CAR COMPANY.

HEAD OFFICE AND WORKS: DETROIT 32, MICH.

President and General Manager: G. T. Christopher.
Vice-President in charge of Engineering: J. G. Vincent.
Executive Vice-President: J. H. Marks.
Director of Engineering: Arthur Nutt.

The Packard Motor Car Co. was incorporated in 1900 for the purpose of manufacturing automobiles, and first entered the Aircraft Industry in 1915. The first experimental Liberty engines were developed by the company and 6,500 of these engines were built under contract during the War.

In 1928, the Packard Company developed the first Diesel air-cooled radial aero-engine. This engine had an official rating from the U.S. Department of Commerce of 225 h.p. at 1,950 r.p.m., and on May 25-28, 1931, a World's Non-refuelling Endurance Record of 84 hrs. 33 mins. was made at Jacksonville, Fla., by Messrs. Walter Lees and Frederick Brossy, in a Bellanca Pacemaker fitted with one of these engines.

In September, 1940, the Packard Company undertook to build the Rolls-Royce Merlin engine for both the American and British Governments. The first two Packard-built Merlin engines to be completed were set in motion on their test-beds at a special ceremony which was held at the Detroit works on August 2, 1941.

Packard-built Rolls-Royce Merlin engines were in full production from 1942. The original Merlin 28 was built under the designation V-1650-1 and supplied for installation in the Curtiss P-40F Warhawk and in the D.H. Mosquito and Avro Lancaster, both British and Canadian built.

In 1944-45 the Packard company was producing the V-1650-3 and V-1650-7. These engines were substantially the same as the Merlin 61 with two-speed two-stage supercharger and were installed in the North American P-51D and R.A.F. Mustang III.

Packard-built Rolls-Royce Merlin 68, Merlin 69 and Merlin 266 engines of the two-speed two-stage supercharger type were used in the later versions of the D.H. Mosquito, Avro Lancaster and Supermarine Spitfire.

PRATT & WHITNEY.

THE PRATT & WHITNEY AIRCRAFT DIVISION OF THE UNITED AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: EAST HARTFORD 8, CONNECTICUT.
Established: 1925.
General Manager: William P. Gwinn.
Engineering Manager: Wright A. Parkins.
Chief Engineer: A. V. D. Willgoos.
Sales Manager: T. E. Tillinghast.
Factory Manager: John L. Bunce.

The Pratt & Whitney Aircraft Division of the United Aircraft Corpn. concentrates on the manufacture of high-powered radial air-cooled engines. It was founded in 1925 by a small group of aeronautical engine experts as the Pratt & Whitney Aircraft Company and has since become affiliated as a division of the United Aircraft Corpn.

During the war period, military requirements for Pratt & Whitney engines necessitated continual and very large expansion of production facilities. New construction at the main plant in East Hartford was supplemented by the establishment of five satellite plants within a twenty-five mile radius. The organization's licencees also expanded proportionately. Four automotive companies—Ford, Buick, Chevrolet and Nash-Kelvinator—and two aviation companies—Jacobs and Continental—built Pratt & Whitney engines without licence fee.

The production of Pratt & Whitney engines constituted almost half of the aircraft engine horsepower used by the U.S. flying services during the war.

Nearly all the new American commercial transports are being powered with Pratt & Whitney engines.

THE PRATT & WHITNEY WASP-JUNIOR R-985 SERIES.

TYPE.—Nine-cylinder air-cooled radial.

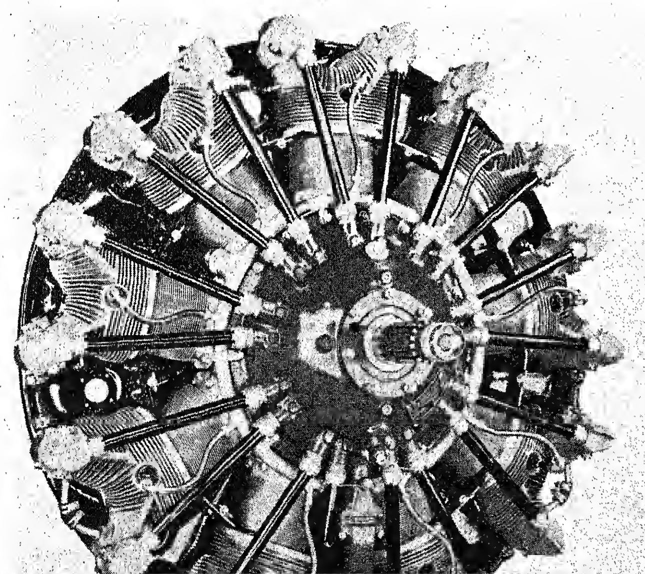
CYLINDERS.—Bore and Stroke $5\frac{3}{16}$ in. (131.76 m/m). Capacity 985 cub. in. (16.14 litres). Compression ratio 6 : 1. Built up of cast-aluminium head with integral valve mechanism housing screwed and shrunk on a forged chrome-molybdenum-steel barrel having integral fins. Individually removable baffles, providing uniform air distribution under severe flight conditions.

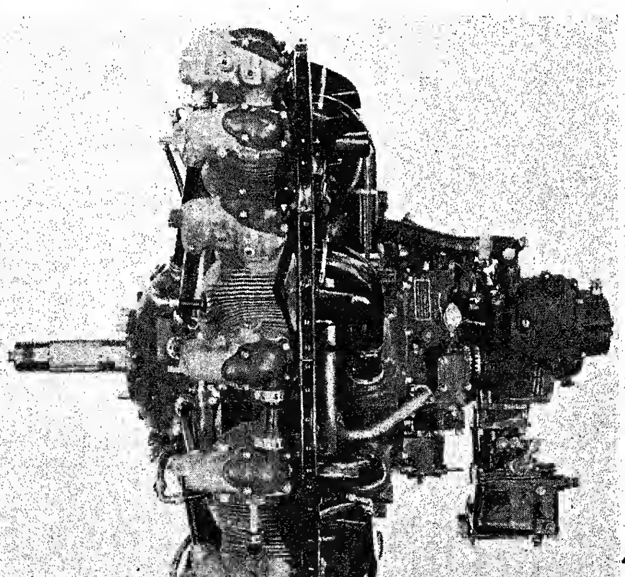
PISTONS.—Machined from aluminium-alloy forgings. Pistons have flat heads with recesses for both intake and exhaust valves. Underside of piston head ribbed for strength and increased cooling area. Three compression rings and two dual oil-control rings and one oil-scraper ring each.

CONNECTING RODS.—Solid master-rod, in which big-end lead-bronze bearing bears directly on crank-pin. Eight I-section articulated rods attached by knuckle-pins to master-rod. Each rod bronze-bushed for both gudgeon and knuckle-pin.

CRANKSHAFT.—Single-throw two-piece type, machined from forged alloy-steel. Shaft supported by three bearings, one roller on each side of crank, with ball thrust-bearing in nose section.

CRANKCASE.—Nose section is a hemispherical magnesium casting. It encloses cam and operating mechanism and carries valve-tappets. Main crankcase, in two similar sections machined together, divided on centre-line of cylinders and united by through-bolts and cylinder flanges, is forged from aluminium-alloy. Blower section contains centrifugal supercharger and mounting lugs for installing engine. Accessory section, in rear, carries all accessories and has integrally-cast vanes in carburettor intake elbow for balanced diffusion of mixture.





The 450 h.p. Pratt & Whitney Wasp-Junior R-985 series nine-cylinder radial air-cooled engine.

PRATT & WHITNEY—*continued.*

THE PRATT & WHITNEY WASP-JUNIOR R-985 SERIES.

Engine Model	Take-off Power	Normal Rating	Military Rating	Compression Ratio	Blower Ratio	Gear Ratio	Weight Dry	Diameter	Octane No.
B5	450 h.p. at 2,300 r.p.m.	450 h.p. at 2,300 r.p.m. at 2,300 ft. (800 m).	—	6 : 1	10 : 1	Direct-drive	682 lb. (309 kg.)	46.10 in. (1,170 m/m.)	91/96
*B4	450 h.p. at 2,300 r.p.m.	450 h.p. at 2,300 r.p.m. at 2,300 ft. (800 m.)	—	6 : 1	10 : 1	Direct-drive	682 lb. (309 kg.)	46.10 in. (1,170 m/m.)	91/96

* For operation with crankshaft in vertical plane (helicopter installations).

Valve Gear.—Completely enclosed. Cam-drum, rotating counter-clockwise at one-eighth crankshaft speed, drives overhead valves through push-rods and rocker-arms.

Induction System.—Stromberg self-priming carburettor with idle cut-off, primer tubing and distributor. Mixture is fed from carburettor through intake elbow containing the diffuser vanes mentioned above to the supercharger and diffuser in the blower section and thence to cylinders by tangential intake pipes.

Supercharger.—Built-in centrifugal type. Impeller-shaft in line with crankshaft and driven from it through a spring-coupling mounted inside the rear crankshaft gear.

Ignition.—Two Scintilla magnetos located on accessory section, each firing spark-plugs in all nine cylinders independently. Pratt & Whitney type dual ignition manifold, front and rear, provides shorter leads to spark-plugs. Radio shielding is incorporated.

Reduction Gear.—Comprises a drive gear splined to the crankshaft and supported by a roller bearing in the anchor plate. A fixed gear is bolted to the nose section and meshes with the six pinions in the gear cage that is splined to the airscrew shaft. Gear ratio 3 : 2.

Dimensions, Weights and Performance.—See Table.

THE PRATT & WHITNEY WASP R-1340 SERIES.

The description of the Wasp is generally similar to that of the Wasp Junior except for the following.

Cylinders.—Bore and Stroke 5¾ in. (146 m/m.), Displacement 1,344 cub. in. (22 litres).

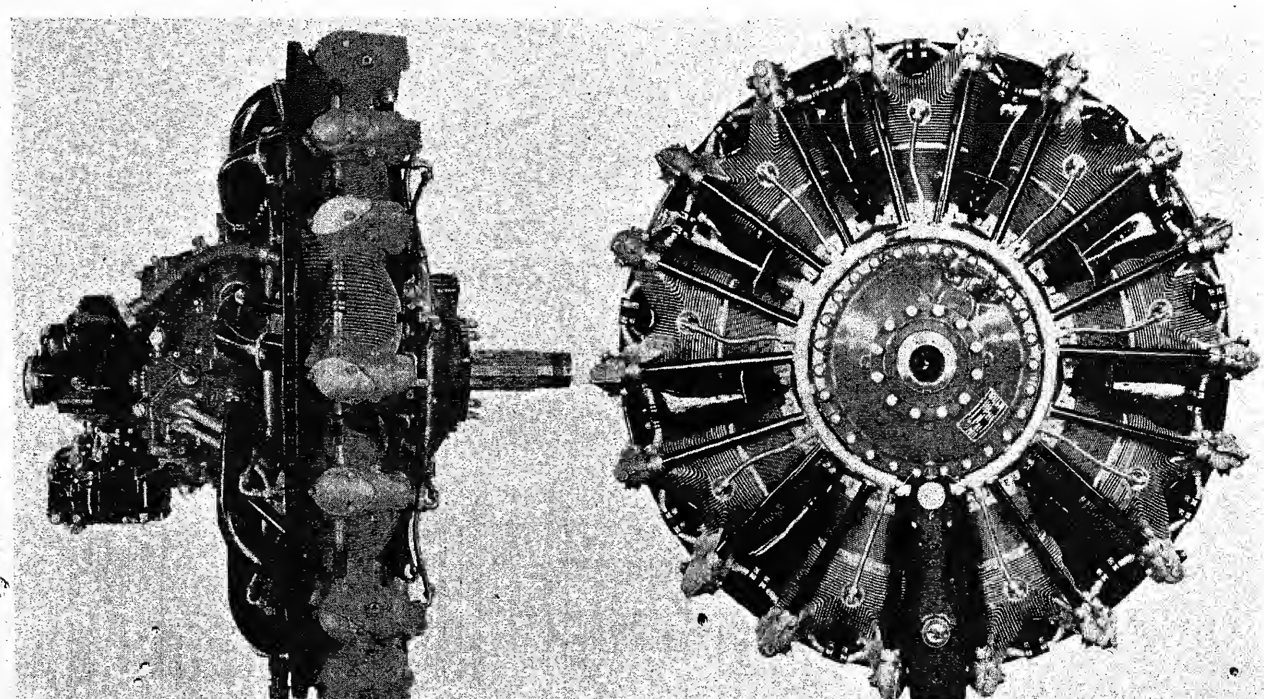
Crankcase.—On geared-drive engines, the nose section is a hemispherical aluminium forging, which houses the planetary reduction gears. There is a pad for mounting the airscrew governor. The airscrew thrust bearing is mounted at the front end of the nose section. The front main crankcase also supports the cam and cam reduction gear. Valve tappets mounted in guides are located in an extension of front main crankcase directly over the cam track.

Lubrication.—Direct-drive engine lubricated by gear type pump located in rear section as in Wasp-Junior, except for internal piping instead of drilled passages in the lower part of the lower section. Geared engines are similar except that there is an oil feed pipe in the reduction gear housing that carries oil to the ball thrust bearing and reduction gears.

THE PRATT & WHITNEY WASP R-1340 SERIES.

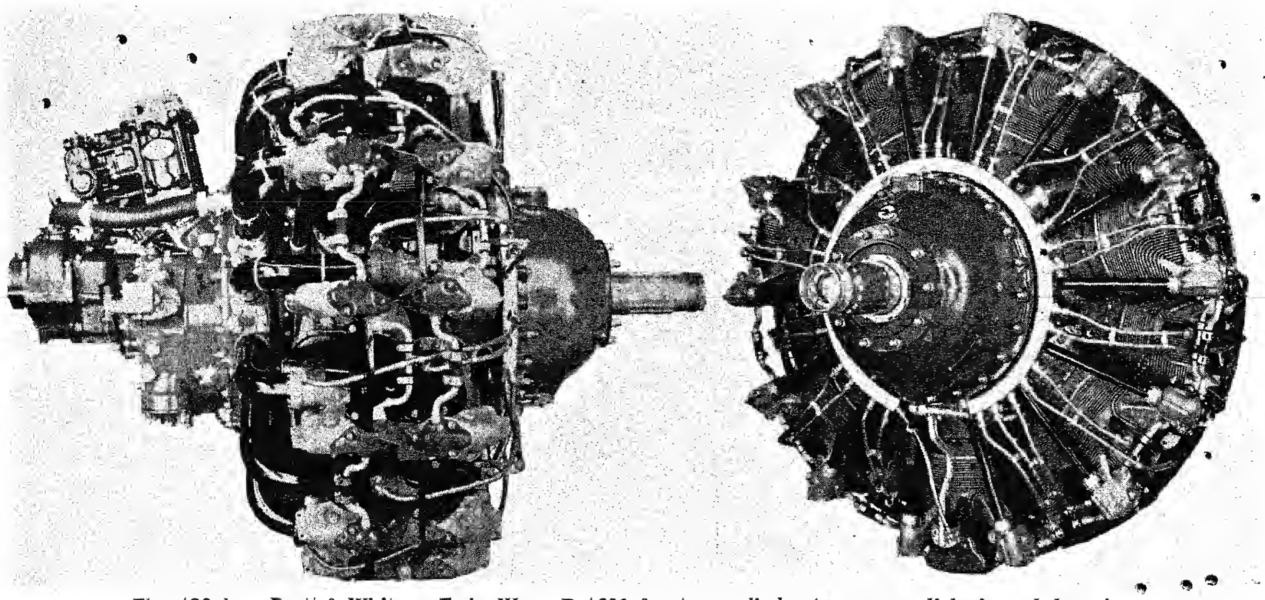
Engine Model	Take-off Power	Normal Rating	Military Rating	Compression Ratio	Blower Ratio	Gear Ratio	Weight Dry	Diameter	Octane No.
S3H1	600 h.p. at 2,250 r.p.m.	550 h.p. at 2,200 r.p.m. at 5,000 ft. (1,525 m.)	600 h.p. at 2,250 r.p.m. at 3,000 ft. (915 m.)	6 : 1	10 : 1	Direct-drive	865 lb. (392 kg.)	51.80 in. (1,315 m/m.)	91/96
S3H1-G	600 h.p. at 2,250 r.p.m.	550 h.p. at 2,200 r.p.m. at 5,000 ft. (1,525 m.)	600 h.p. at 2,250 r.p.m. at 3,000 ft. (915 m.)	6 : 1	10 : 1	3 : 2	938 lb. (425 kg.)	51.80 in. (1,315 m/m.)	91/96

Note.—The S3H2 engine is identical to the S3H1 except that it is intended to be mounted with crankshaft vertical for helicopter installations.



The 600 h.p. Pratt & Whitney Wasp R-1340 nine-cylinder radial air-cooled engine.

PRATT & WHITNEY—*continued.*



The 120 h.p. Pratt & Whitney Twin-Wasp R-1830 fourteen-cylinder two-row radial air-cooled engine.

REDUCTION GEAR.—Comprises a drive gear splined to the crankshaft and supported by a roller bearing in the anchor plate. A fixed gear is bolted to the nose section and meshes with the six pinions in the gear cage that is splined to the airscrew shaft. Gear ratio 3 : 2.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE PRATT & WHITNEY TWIN-WASP R-1830 SERIES.

TYPE.—Fourteen-cylinder two-row air-cooled radial.

CYLINDERS.—Bore and Stroke 5½ in. (139.50 m/m.), Capacity 1,830 cub. in. (30 litres). Compression ratio 6.7 : 1. Built up of cast aluminium head, with integral valve mechanism housing, screwed and shrunk on a forged steel cylinder barrel having integral fins. Exhaust ports have shrunk-in stainless-steel liners providing slip joint with exhaust steel pipes. Chrome-molybdenum cylinder-barrels are machined from steel forging, tapered towards hemispherical combustion chamber, thus compensating for expansion and providing longer life. Aluminium-bronze valve-seats for intake, steel for exhaust, are shrunk into head. Pressure-baffles to provide uniform cooling to entire cylinder in all flight conditions standard.

PISTONS.—Forged aluminium, ribbed on under side of head for strength, have finned inner skirts for additional cooling surface. Three compression rings, one oil scraper ring and one dual oil control ring each.

CONNECTING RODS.—Two-piece master-rod, with detachable big-end cap and lead-silver bearing and six I-section articulated rods for each row. Each articulated rod is bronze-bushed for both gudgeon and knuckle-pins.

CRANKSHAFT.—Two-throw one-piece type, supported by three roller-bearings in crankcase sections, and located by the front main bearing. Airscrew-shaft is supported within crankshaft by lead-copper pilot bearing and in nose section by deep-groove ball-bearing which absorbs engine thrust.

CRANKCASE.—In six sections. Power sections machined together from aluminium forgings. Nose section houses reduction gears and has provision for Hamilton Standard Hydromatic full-feathering, or other controllable airscrews. A drilled oil passage in upper part of nose section provides means for operating airscrew pitch control. Power sections joined by through-bolts. Blower section, bolted to power section, contains supercharger and carries bronze-bushed forged steel lugs for mounting bolts. Blower intermediate section, bolted to blower section, carries down-draught carburettor and impeller gear train. Accessory section of new design is bolted to blower intermediate section.

VALVE GEAR.—One inlet and one exhaust valve per cylinder. Exhaust valves are sodium-cooled and have stellite seats. Actuated by ball-bearing rocker-arms and push-rods of heat-treated aluminium-alloy with hardened steel ball-ends. Two shelf-mounted cams, one in front power section and one in rear, are driven by spur reduction gears directly off crankshaft at one-eighth crankshaft speed. All valve gear, including push-rods, is completely enclosed and oil-tight. Internally-drilled passages provide lubrication for push-rods and rocker-arm bearings.

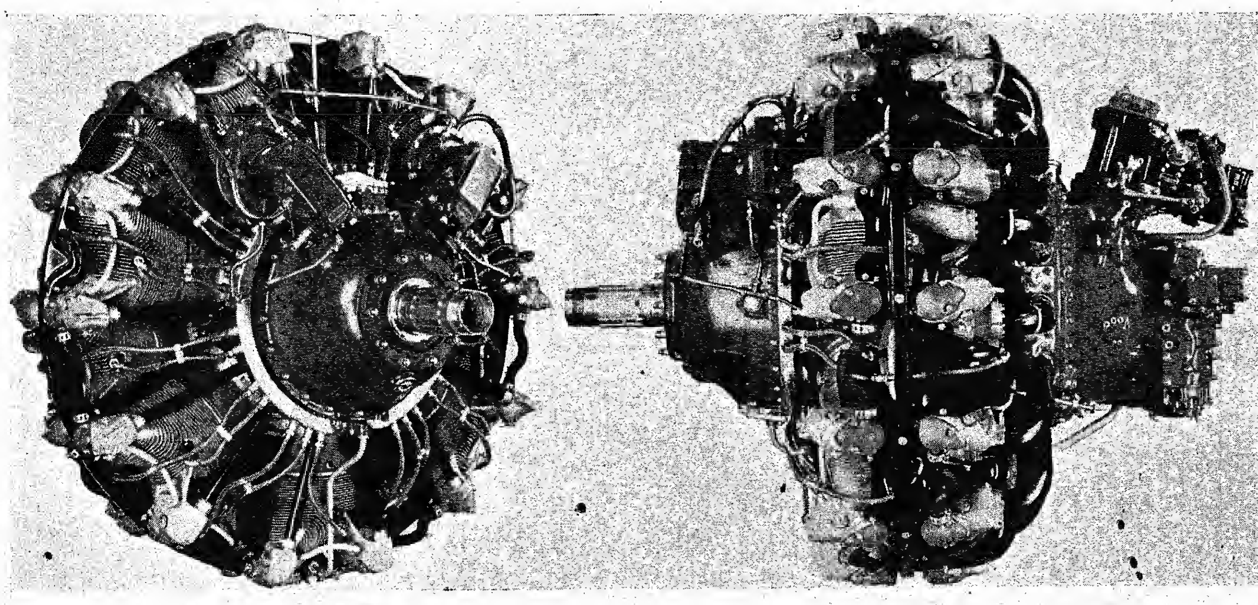
SUPERCHARGER.—Single-stage single-speed. Large diameter impeller of improved design, carried by high-capacity ball-bearings, is driven by dual intermediate gears containing spring-type flexible drives to absorb shocks and to equalize driving loads.

INDUCTION SYSTEM.—One Stromberg injection carburettor with automatic mixture control, idle cut-off, primer tubing and distributor, from which mixture passes through vanes in intermediate rear section of supercharger, through diffuser plate and induction passages, providing uniform distribution and contributing to improved performance at height levels.

IGNITION.—Two Scintilla flange-mounted magnetos each operate independent set of spark-plugs through single ignition manifold which is attached to the front of the power section to simplify maintenance and provide shortest possible leads. Radio shielding is standard.

LUBRICATION.—Forced-feed lubrication by gear type oil pump with separate low-pressure system to accessory drives in rear-section regulated by independent low-pressure relief-valve. Inter-rocker box and inter-cylinder drain-pipes connect to separate sump from which the return oil is scavenged by pump located in nose.

REDUCTION GEAR.—Pratt & Whitney planetary reduction gear; .5625 : 1 ratio.



The 1,450 h.p. Pratt & Whitney Twin-Wasp R-2000 fourteen-cylinder two-row radial air-cooled engine.

PRATT & WHITNEY—*continued.*

THE PRATT & WHITNEY TWIN-WASP R-1830 AND R-2000 SERIES.

Engine Model	Take-off Power	Normal Rating (low blower)	Normal Rating (high blower)	Military Rating (low blower)	Military Rating (high blower)	Com-pression Ratio	Gear Ratio	Weight Dry	Diameter	Fuel Grade
S1C3-G (R-1830)	1,200 h.p. at 2,700 r.p.m.	1,050 h.p. at 2,550 r.p.m. at 7,500 ft. (3,385 m.)	—	1,200 h.p. at 2,700 r.p.m. at 4,900 ft. (1,495 m.)	—	6.7 : 1	.5625 : 1	1.467 lb. (665 kg.)	48.19 in. (1.224 m.)	91/96
2SD13-G (R-2000)	1,450 h.p. at 2,700 r.p.m.	1,200 h.p. at 2,550 r.p.m. at 5,000 ft. (1,525 m.)	1,100 h.p. at 2,550 r.p.m. at 14,000 ft. (4,270 m.)	1,450 h.p. at 2,700 r.p.m. at 1,000 ft. (305 m.)	1,100 h.p. at 2,700 r.p.m. at 16,000 ft. (4,880 m.)	—	—	1.595 lb. (724 kg.)	49.10 in. (1.247 m.)	100/130
D-3 (R-2000)	1,450 h.p. at 2,700 r.p.m.	—	1,200 h.p. at 2,550 r.p.m.	1,450 h.p. at 2,700 r.p.m. at 100 ft. (30.5 m.)	—	—	—	1,570 lb. (712.8 kg.)	49.10 in. (1,247 m.)	100/130

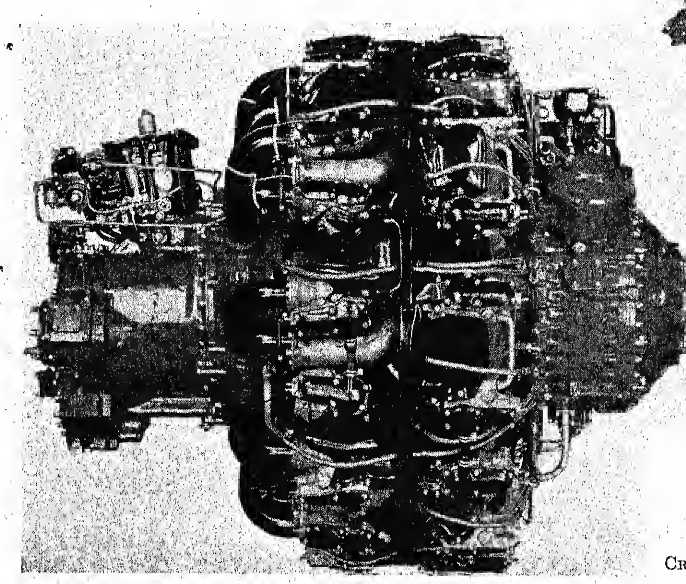
Accessory Drives.—All accessories are grouped in the rear and are driven through an intermediate gear train by a single-drive shaft splined directly to the rear of the crankshaft. Provision is made to drive two gun-synchronizers or auxiliary accessory pumps, two magnetos, two tachometers, vacuum pump, oil pump, fuel pump, starter and generator drives. Generator drive may be used as a 30 h.p. take-off to drive a remote accessory gear-box. Pressure lubrication through drilled passages is provided for vacuum pump drive and gun-synchronizer or auxiliary drives.

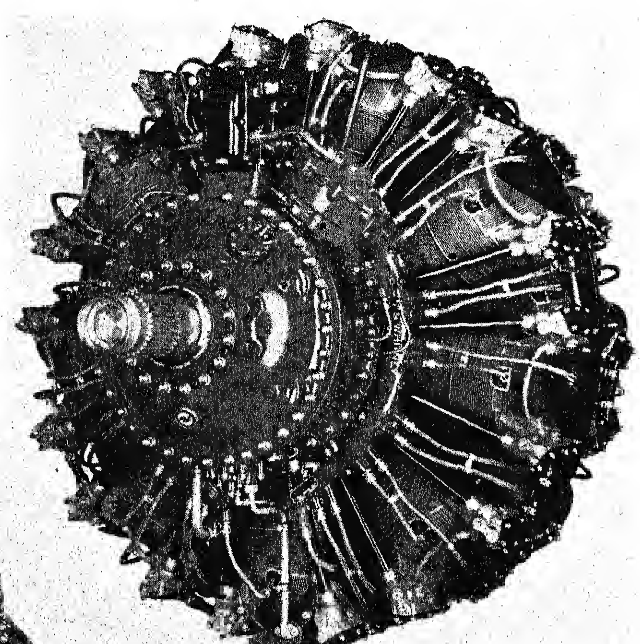
Dimensions, Weights and Performance.—See Table.

THE PRATT & WHITNEY TWIN-WASP R-2000 SERIES.

The R-2000 Twin-Wasp is a development of the R-1830 Series. As its designation implies it is of slightly bigger capacity and has a maximum output of 1,450 h.p.

The R-2000 has new cylinders with the bore increased to 5.75 in. (146 m/m.) and a single-stage two-speed supercharger, but retains the crankcase, crankshaft, connecting-rods, etc., of the R-1830. It was designed for use in the Douglas DC-4 and is not installed in any other aeroplane. For weight and performance data see R-1830 and R-2000 Table.





Side and three-quarter front views of the 2,100 h.p. Pratt & Whitney Double-Wasp R-2800 Series eighteen-cylinder radial engine.

THE PRATT & WHITNEY DOUBLE-WASP R-2800 SERIES.

Type.—Eighteen-cylinder two-row air-cooled radial.

Cylinders.—Bore 5¾ in. (146 m/m.), Stroke 6 in. (152.4 m/m.), Capacity 2,804 cub. in. (45.9 litres). Built up of forged aluminium head, with integral valve mechanism housing, screwed and shrunk on a forged steel cylinder barrel. Forged aluminium sleeves in which deep-cut cooling fins have been machined, are shrunk over the central portion. Each cylinder has one inlet and one exhaust valve, the inlet seating on a bronze insert and the exhaust on a steel insert, both of which are shrunk into the head. Pressure baffles are provided.

Pistons.—Forged aluminium pistons of full skirt type. Three compression rings, one pair of dual oil control rings and one oil scraper ring. Top compression ring chromium plated on the face which bears against the cylinder wall.

Connecting Rods.—The rod assembly consists of a one-piece master rod and eight I-section articulated rods attached to each master rod by knuckle pins. The master rod bearings are one-piece steel shells covered on the inside and outside with leaded silver. The articulated rods have bronze bushings at the piston pin end and ride on silvered knuckle pins at the knuckle pin end.

Crankshaft.—Two-throw crankshaft machined from three steel forgings which divide at the crankpins and are joined together by a face spline and bolt. Crankshaft assembly supported by steel-backed lead-silver bearings mounted in the front, centre and rear main crankcase sections. Weights of reciprocating and rotating parts connected to the crankpin are counterbalanced by weights, part of which are mounted as bifilar dampers. Mounted at each end of the crankshaft are two counterweights revolving at twice crankshaft speed to eliminate second-order "linear" vibration.

Crankcase.—Main crankcase composed of three forged aluminium-alloy sections held together by through bolts. The front, centre and rear sections are one-piece. Nose section houses the reduction gears and has provisions for full-feathering or other controllable propellers. Supercharger case attached to the rear of the main crankcase section and houses an impeller and the supercharger rim. Intermediate rear case is attached to supercharger case and supports at its forward face a vaned diffuser plate and provides mounting surface for a pressure type carburettor. Rear section provides accessory mounting pads.

Valve Gear.—One inlet and one exhaust valve per cylinder. Exhaust valves are sodium-cooled and faced with stellite. Rocker arms with plain bearings are actuated by steel push-rods with hardened steel ball ends. Push-rod covers are of one-piece construction. Two shelf-mounted cams, one in the front power section and one in the rear power section, are driven by spur reduction gears directly off crankshaft. All valve gear completely enclosed and oil-tight. Internally drilled oil passages provide lubrication for push-rods and rocker-arm bearings.

Induction System.—Stromberg injection carburettor with automatic mixture control, idle cut-off, primer tubing and distributor. Metered fuel is carried through internal passages and is thrown centrifugally through small holes in a slinger ring mounted on the impeller shaft. (When water injection is used, the water is also introduced into the induction system through the slinger ring). Combustion air enters the supercharger at right angles to the screen of vaporised fuel (or fuel-water mixture) thrown from the slinger ring. The fuel-air (water-vapour) mixture, after being compressed, collects in the supercharger rim from where it is carried through nine siamezed intake pipes to the eighteen individual cylinders. The "washboard" impeller case provides better fuel

PRATT & WHITNEY—*continued.*

THE PRATT & WHITNEY DOUBLE-WASP R-2800 SERIES.

Engine Model	Take-off Power	Normal Rating (low blower)	Normal Rating (high blower)	Military Rating (low blower)	Military Rating (high blower)	Com-pression Ratio	Gear Ratio	Weight Dry	Diameter	Fuel Grade
*CA3	‡2,400 h.p. at 2,800 r.p.m. 2,100 h.p. at 2,800 r.p.m.	1,700 h.p. at 2,600 r.p.m. at 7,300 ft. (2,230 m.)	—	—	—	—	.35, .45 or .5625 : 1	2,327 lb. (1,065 kg.)	52.8 in. (1,342 m/m.)	100/130
*CA5	2,300 h.p. at 2,800 r.p.m.	1,800 h.p. at 2,600 r.p.m. at 6,500 ft. (1,980 m.)	—	—	—	—	.35, .45 or .5625 : 1	2,327 lb. (1,065 kg.)	52.8 in. (1,342 m/m.)	115/145
†CA15	‡2,400 h.p. at 2,800 r.p.m. 2,100 h.p. at 2,800 r.p.m.	1,700 h.p. at 2,600 r.p.m. at 7,300 ft. (2,230 m.)	1,500 h.p. at 2,600 r.p.m. at 17,500 ft. (5,340 m.)	2,100 h.p. at 2,800 r.p.m. at 3,000 ft. (915 m.)	1,700 h.p. at 2,800 r.p.m. at 16,000 ft. (4,880 m.)	—	.35, .45 or .5625 : 1	2,360 lb. (1,072 kg.)	52.8 in. (1,342 m/m.)	100/130
†CA17	2,300 h.p. at 2,800 r.p.m.	1,800 h.p. at 2,600 r.p.m. at 7,300 ft. (2,230 m.)	1,600 h.p. at 2,600 r.p.m. at 16,000 ft. (4,880 m.)	—	—	—	.35, .45 or .5625 : 1	2,360 lb. (1,072 kg.)	52.8 in. (1,342 m/m.)	115/145

* Single-speed single-stage supercharger. † Single-speed two-stage supercharger. ‡ With water injection.

vaporization, preventing the accumulation and flow of liquid fuel along the diffuser wall by returning it to the air stream.

SUPERCHARGER.—Single-stage supercharger may be either single-speed or two-speed. The impeller is driven by a spring-loaded flexible drive gear to absorb shocks and to equalise driving loads, plus cone-clutches with creeper desludgers in the case of two-speed drive engines.

IGNITION SYSTEM.—Front-mounted dual magneto and two distributors serve two spark plugs in each cylinder through a single ignition manifold or harness attached to the front of the power section. The magneto, manifold and spark plug leads are radio-shielded.

LUBRICATION.—Forced-feed lubrication is provided by gear-type oil pumps to all parts of the engine.

REDUCTION GEAR.—The planetary reduction gears are of Pratt & Whitney Aircraft design and are optionally of a reduction ratio of .35, .45 or .5625 : 1. The propeller shaft is supported in the crankshaft by a lead-copper pilot-bearing and in the nose section by a deep-groove ball-bearing which absorbs propeller thrust. The axially floating ring gear is an integral part of an hydraulically-operated torquemeter.

ACCESSORY DRIVES.—All accessories are grouped in the rear and are driven through an intermediate gear train by a single driveshaft, spline-fitted to the rear of the crankshaft.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

PRATT & WHITNEY WASP-MAJOR R-4360 SERIES.

TYPE.—Twenty-eight-cylinder four-row air-cooled radial.

CYLINDERS.—Bore 5¾ in. (146 m/m.), Stroke 6 in. (152.4 m/m.), Capacity 4,363 cub. in. (71.5 litres). Cylinders, which are similar to those of R-2800 Series, are arranged helically around the crankcase and pressure baffles are provided for individual cylinders and for each bank of four. All cylinders are completely interchangable.

PISTONS.—Forged aluminium pistons of full-skirt type. Three compression rings, one dual oil control ring and one oil scraper ring. The top compression ring is chromium-plated on the face which bears against the cylinder wall.

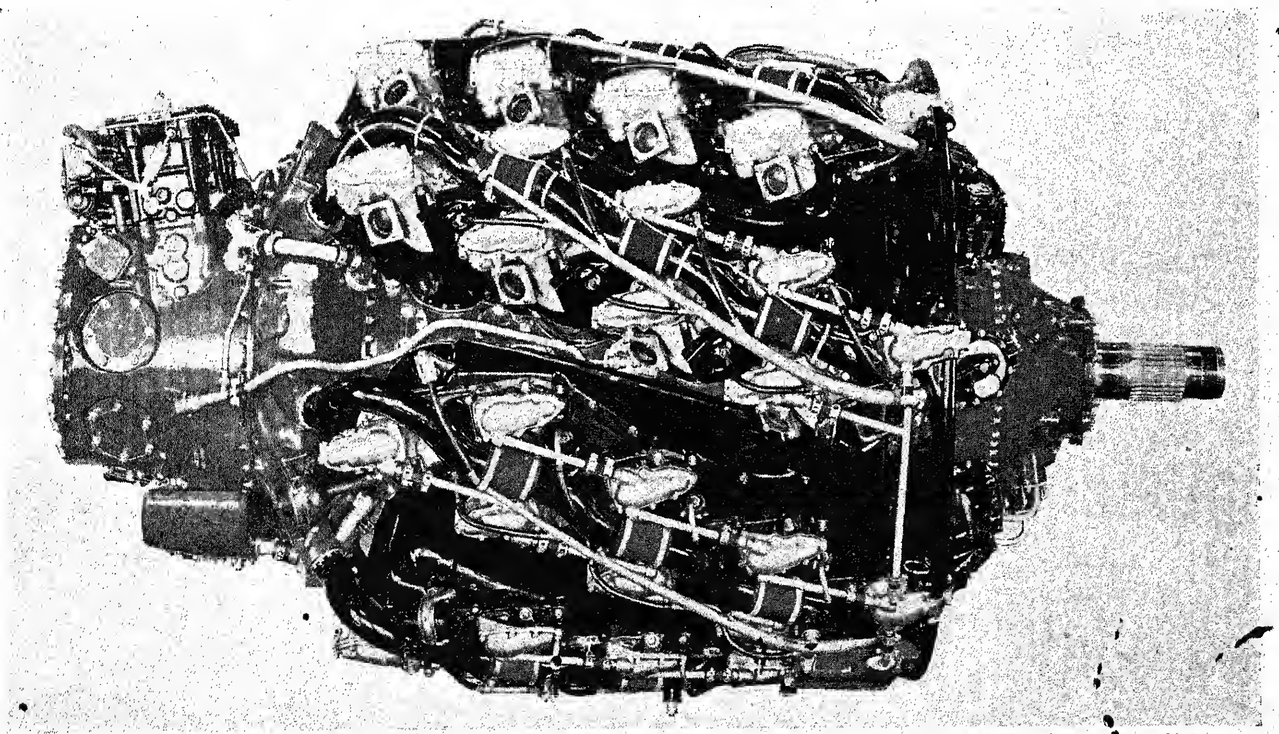
CONNECTING RODS.—Rod assembly for each row of seven cylinders consists of master rod with detachable cap, two-piece lead-silver bearing, and six I-section articulated or link rods. Each link rod has a bronze bushing at the piston end and rides on a silvered knuckle pin.

CRANKSHAFT.—One-piece crankshaft of forged steel has four throws and is supported in the crankcase by five steel-backed lead-silver main bearings. Weights of the reciprocating parts connected to the crankpin are counterbalanced by fixed and bifilar counterweights.

AIRSCREW SHAFT.—Supported at the crankshaft end by a plain lead-bronze bearing and at the airscrew end by a roller-bearing to carry radial loads and a deep-groove ball-bearing which absorbs engine thrust.

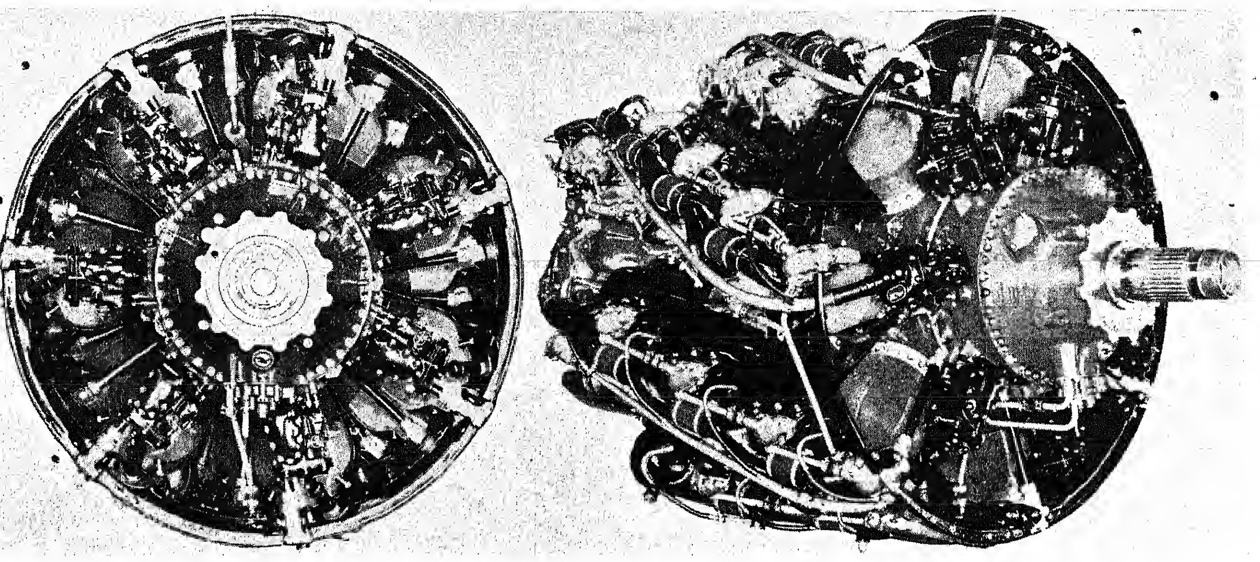
CRANKCASE.—The power section case made up of five sections, all except the front and rear sections being interchangeable. The parts for the power section are machined from aluminium forgings and are held together with through bolts. All other crankcase sections are magnesium castings. Attached to front of power section by studs are the magneto section, which mounts seven interchangeable magnetos, and the nose section, which houses the planetary reduction gearing and the torquemeter and has provision for full-feathering or other controllable airscrews. Attached to rear of power section by studs is the supercharger housing, enclosing the supercharger drives and impeller. Behind the supercharger housing, also attached with studs, is the rear section. On this is mounted a down-draft pressure-type carburettor. Rear section houses the accessory-drive mechanism and provides mounting pads for the radial mounting of all accessories to permit greater accessibility for servicing. Nothing is mounted on the rear of the engine.

VALVE GEAR.—Rocker boxes are part of the cylinder head, extending fore and aft. Rocker arms with plain bearings are actuated by enclosed push-rods. Shelf-mounted cams, intake track in front



Side view of the 3,000 h.p. Pratt & Whitney Wasp-Major R-4360 Series twenty-eight cylinder four-row radial air-cooled engine.

PRATT & WHITNEY—*continued.*



The 3,000 h.p. Pratt & Whitney Wasp-Major R-4360 Series twenty-eight cylinder four-row radial air-cooled engine.

and exhaust track in rear, serve each row of cylinders and are driven by spur reduction-gears from the crankshaft at one-sixth crankshaft speed.

INDUCTION SYSTEM.—Stromberg four-barrel pressure-type carburettor, with automatic mixture control, idle cut-off, primer tubing and distributor; from which metered fuel is carried through internal passages and is thrown centrifugally through small holes between the impeller blades to mix with the combustion air. The fuel-air mixture, after passing through the diffuser to the blower rim, is carried to the cylinders through seven intake pipes, one for each bank of four cylinders.

SUPERCHARGER.—There are two basic types in unrestricted engines: a single-stage single-speed supercharger suitable for use with an exhaust driven turbo-supercharger, and a single-stage hydraulically-driven variable-speed supercharger. The two-piece impeller assembly consists of a machined impeller, the straight blades of which are blended with the curved entrance blades of an inducer.

IGNITION SYSTEM.—Seven Scintilla shielded magnetos, each with an integral distributor, operate at one-half crankshaft speed. Through a short whip-type harness each magneto provides dual ignition for the bank of four cylinders directly behind it.

LUBRICATION.—Forced-feed lubrication provided by a gear-type oil pump to all parts of the engine.

REDUCTION GEAR.—The planetary reduction gears are of Pratt & Whitney design and are spur gears with optional ratios of .381 or .425 : 1.

ACCESSORY DRIVES.—All accessories mounted radially on the periphery of the rear section. All accessory-drive gears driven by a bevel-gear revolving at crankshaft speed.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE PRATT & WHITNEY WASP-MAJOR R-4360 SERIES.

Engine Model	Take-off Power	Normal Rating (low blower)	Normal Rating (high blower)	Military Rating (low blower)	Military Rating (high blower)	Compression Ratio	Gear Ratio	Weight Dry	Diameter	Fuel Grade
*TSB3-G	‡3,500 h.p. at 2,700 r.p.m. 3,250 h.p. at 2,700 r.p.m.	2,650 h.p. at 2,500 r.p.m. at 5,500 ft. (1,680 m.)	—	—	—	—	.381 : 1	3,470 lb. (1,575 kg.)	53.5 in. (1,360 m/m.)	115/145
†VSB11-G	3,000 h.p. at 2,700 r.p.m.	2,500 h.p. at 2,550 r.p.m. at 5,000 ft. (1,525 m.)	2,200 h.p. at 2,550 r.p.m. at 14,500 ft. (4,420 m.)	3,000 h.p. at 2,700 r.p.m. at 1,500 ft. (460 m.)	2,400 h.p. at 2,700 r.p.m. at 13,500 ft. (4,120 m.)	—	.381 : 1	3,405 lb. (1,546 kg.)	53.5 in. (1,360 m/m.)	100/130

* Single-speed single-stage supercharger. † Single-stage variable-speed supercharger. ‡ With water injection.

RANGER.

RANGER AIRCRAFT ENGINE DIVISION OF THE FAIRCHILD ENGINE AND AIRPLANE CORPORATION.

HEAD OFFICE AND WORKS: FARMINGDALE, L.I., N.Y.
Chairman of the Board: Sherman M. Fairchild.
President: J. Carlton Ward, Jr.
Vice-President and General Manager: Harold H. Budds.
Director of Engineering: E. M. Lester.
Chief Engineer: A. T. Gregory.

The Ranger Aircraft Engines Division directs its principal activity to the development of in-line, inverted, aircooled engines. During the war it greatly enlarged its facilities for the production of engines for the American Armed Forces. Besides producing, in quantity, two basic types of engines, the 6-440C Series and the SGV-770C Series, Ranger also manufactured assemblies for the American-built Rolls-Royce engines, auxiliary power-units which provided electrical current for large aircraft, and miscellaneous parts for the Armed Forces.

The 6-440C engines were used extensively in such training aircraft as the Fairchild PT-19 and PT-26. They are also being used in personal-type aircraft, notably the Grumman Widgeon twin-engined amphibian, and the Fairchild F-24 four-seat cabin monoplane.

During the war the SGV-770 Series engines were used in training and scout aircraft. The SGV-770C-1B model was used as the power-plant for the Curtiss SO3C Scout-Observation monoplane and the SGV-770C-2 model powered the twin-engined Fairchild AT-21 bomber-crew trainer. Considerable development is being undertaken on the SGV-770 type engine.

THE RANGER 6-440C SERIES.

TYPE.—Six-cylinder in-line inverted aircooled.

CYLINDERS.—Bore $4\frac{1}{8}$ in. (10.48 m/m.), Stroke $5\frac{1}{2}$ in. (128.8 m/m.). Capacity 441 cub. in. (7.2 litres). Cylinder barrels are chrome-molybdenum steel forgings with integral fins and mounting flange. Cast aluminium-alloy heads have integral fins, spherically-machined combustion chamber and are screwed and shrunk on the barrels. Aluminium-bronze valve-seats, one inlet and one exhaust, are shrunk on to the heads. Two sparking-plug inserts are shrunk and screwed in and pinned.

PISTONS.—Machined from aluminium-alloy. Three $\frac{3}{32}$-in. (2.28 m/m.) compression rings and one oil scraper ring. Gudgeon pins are of heat-treated alloy steel, retained by snap rings.

CONNECTING RODS.—I-section machined from chrome-molybdenum steel forgings. Steel-backed cadmium silver bearing shells used for main rod bearings and bronze bushings for the little ends.

CRANKSHAFT.—Six-throw, seven bearing shaft, statically and dynamically balanced to close limits. Main journals and crank-pins are hollow and fitted with oil plugs. These plugs act as centrifugal oil cleaners and also as oil transfers from main journals to crank-pins. Crank cheeks are drilled for two-way feeding of oil from main journals to crank-pins. Rear end of shaft carries standard starter jaw. Front end has a Standard No. 20 S.A.E. spline for the airscrew hub. Three pendulum-type vibration dampers are located on the first throw (rear) of the crankshaft.

CRANKCASE.—Barrel type of heat-treated aluminium-alloy ribbed for seven main bearings split longitudinally and clamped together by long studs anchored in the upper webs and extending through lower webs. Front section carries airscrew thrust bearing and gears for driving accessory drive shaft and vertical camshaft drive shaft. Rear section carries drive gears for the accessories.

VALVE GEAR.—Underhead camshaft is a heat-treated alloy steel forging carried in housing bolted direct to cylinder-heads. Supported on seven bearings, one at front end and one adjacent to each of six pairs of cams. Valves operated by rocker-arms, provided with crowned roller cam followers and ball-type adjusting screws. From hollow camshaft pressure oil is fed direct to camshaft bearings. Holes drilled in camshaft between each pair of cams supply a spray of oil to rocker-arms, cam followers and

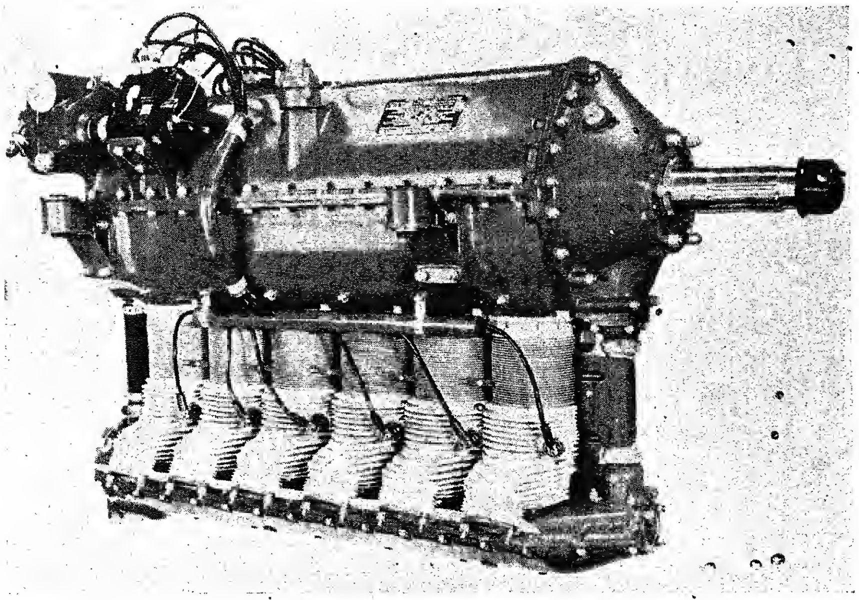
RANGER—*continued.*

adjusting screws. Camshaft housing and cover of magnesium-alloy, cover serving as engine oil sump. Torsional vibration damper on rear camshaft.

CARBURATION.—One Stromberg or Marvel-Schebler updraught carburettor supported on a dividing Tee bolted to crankcase on left side between cylinders 3 and 4. Tee connects carburettor with two pipes leading to two manifolds, each of which supplies three cylinders.

IGNITION.—Two Bendix-Scintilla type SB6R magnetos mounted on upper crankcase at rear. Plain ignition wiring and sparking-plugs. Shielded wiring and sparking-plugs optional.

ACCESSORY DRIVES.—Drives for all accessories, and mounting pads and connections located at convenient points on rear of engine. They consist of starter, generator, fuel pump, vacuum pump and tachometers. Drives are protected from crankshaft torsional vibration and shock loading by a long hollow flexible shaft in top of crankcase upper section. This shaft transmits the drive from the airscrew end to the accessory drives in the rear section and isolates them from any detrimental vibrations. Accessory drive shaft carried in seven main bearings in the crankcase webs and acts as a header for the distribution of oil to main bearings and front end of engine.



The 200 h.p. Ranger 6-440-C six-cylinder inverted air-cooled engine.

LUBRICATION.—Full pressure type. Pump on crankcase rear section feeds oil through hollow engine shafts and cast-in passages, there being no external pressure oil pipes on engine. Return oil drains from crankcase to camshaft housing through camshaft vertical drive shaft housing at the front and drain pipe at rear. Double suction scavenge pump on rear of camshaft housing returns oil through either end of housing to supply tank.

COOLING.—Pressure-type cylinder baffles are standard equipment.

DIMENSIONS.—Length overall 53.156 in. (1.351 m.), Width overall 21.594 in. (0.549 m.), Height overall 33.50 in. (0.854 m.).

WEIGHTS AND PERFORMANCE.—See Table.

THE RANGER SGV-770C-1B.

CYLINDERS.—Bore 4 in. (101.6 m/m.), Stroke 5.125 in. (120 m/m.). Capacity 773 cub. in. (12.6 litres). Aluminium cooling fins chemically bonded to steel barrels by Fairchild Alfin process. Otherwise as for 6-440C Series.

PISTONS.—Same as for 6-440C Series.

CONNECTING RODS.—Fork-and-blade type. Lead-plated steel-backed copper-lead bearings held in the forked rods, the blade rods bearing on the outer diameter of the shells between the forks.

CRANKSHAFT.—Same as for 6-440C Series except four pendulum-type dampers on crank cheeks.

CRANKCASE.—Same as for 6-440C Series.

VALVE GEAR.—Two underhead camshafts, each driven from a separate vertical drive shaft from front end of crankshaft. Gear and lubrication as for 6-440C Series.

CARBURATION.—Bendix injection carburettor feeds inlet side of the supercharger housing in the crankcase rear section.

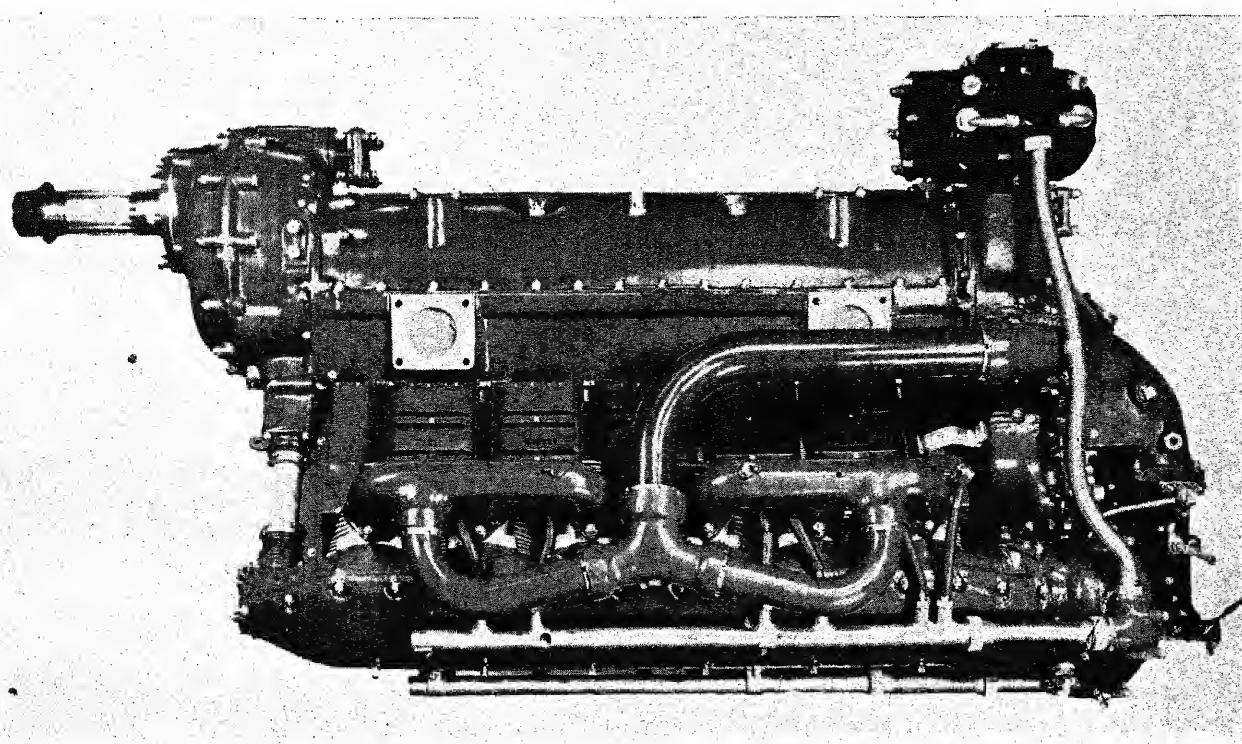
IGNITION.—Scintilla double magneto with two twelve-cylinder distributors on upper crankcase at rear. Radio shielding.

ACCESSORY DRIVES.—Similar to 6-440C Series except that the accessory drive shaft is located in the lower section of the crankcase at the point of the vee formed by the cylinder-blocks. Accessory drives for starter, generator, gun synchroniser, magneto, distributor, fuel pump, vacuum pump, hydraulic mechanism fuel pump, mechanical tachometer and electric tachometer.

LUBRICATION.—Same as for 6-440C Series.

REDUCTION GEAR.—Gear ratio 3 : 2. Herring-bone type. A short flexible quill shaft with gear-tooth splines at both ends provides drive from the crankshaft to the pinion gear installed concentrically over the quill shaft. This unit floats on two sets of roller-bearings and is located axially by the meshing of the herring-bone teeth with the teeth of the driven reduction gear. The latter is bolted to the airscrew shaft which, in turn, is mounted directly above the quill shaft on two roller-bearings. Thrust ball-bearing locates the airscrew shaft. Lubrication by controlled metering jet from the pressure lubricating system.

SUPERCHARGER.—Single-speed single-stage type. Impeller is driven from the flexible accessory drive shaft, thus eliminating need for clutch in supercharger drive. Distribution from supercharger is through two induction pipes, each supplying one bank of cylinders. A special Y-fitting on each induction pipe divides the charge equally, and distributes it to two manifolds, each of which supplies three cylinders. Blower ratio 9.5 : 1.



The 520 h.p. Ranger SGV-770C twelve-cylinder inverted Vee air-cooled engine.

RANGER—continued.

RANGER AERO-ENGINES.

	6-440C-2 Six-cylinder	6-440C-5 Six-cylinder	SGV-770C-1B Twelve-cylinder geared and supercharged	SGV-770-2A Twelve-cylinder geared and supercharged
Bore	4⅛ in. (104.8 m/m.)	4⅛ in. (104.8 m/m.)	4 in. (101.6 m/m.)	4 in. (101.6 m/m.)
Stroke	5½ in. (128.8 m/m.)	5½ in. (128.8 m/m.)	5⅛ in. (120 m/m.)	5⅛ in. (120 m/m.)
Capacity	441 cu. in. (7.2 litres)	441 cu. in. (7.2 litres)	773 cu. in. (7.2 litres)	773 cu. in. (12.6 litres)
Compression Ratio	6.0 : 1	7.5 : 1	6.5 : 1	6.5 : 1
Gear Ratio	—	—	3 : 2	3 : 2
Weight (Dry) including standard equipment	382 lb. (173.4 kg.)	382 lb. (173.4 kg.)	754 lb. (342.3 kg.)	754 lb. (342.3 kg.)
Take-off Power	—	—	520 h.p. at 3,150 r.p.m.	550 h.p. at 3,300 r.p.m.
Rate Power	175 h.p. at 2,450 r.p.m.	200 h.p. at 2,450 r.p.m.	450 h.p. at 3,000 r.p.m. to 12,000 ft. (3,660 m.)	500 h.p. at 3,150 r.p.m. to 8,000 ft. (2,440 m.)
Fuel Grade	65	87	91	130

DIMENSIONS.—Length overall 62 in. (1.573 m.), Width overall 28 in. (0.71 m.), Height overall 32.25 in. (0.823 m.).
WEIGHT AND PERFORMANCE.—See Table.

THE RANGER SGV-770C-2A.

The SGV-770C-2A is similar to the C-1B previously described except that the blower ratio is 8.84 : 1. For performance details see Table.

THAHELD.

DIESEL POWER, INC.

Division of the Shafter Tool Works.

HEAD OFFICE: BREA, CALIFORNIA.

Mr. Fred A. Thaheld has designed two prototype flat-four air-cooled Diesel engines suitable for installation in light touring and training aircraft. The two prototypes, of 100 h.p. and 120 h.p. respectively, are identical in design and construction, with all components interchangeable except for a slight modification of the fuel injection system. Following 700 hours of bench tests the 100 h.p. engine has been installed in a Stinson Voyager for flight tests.

Mr. Thaheld was for sixteen years vice-president and chief engineer of the Guiberson Diesel Engine Co., and was responsible for the design and construction of the Guiberson A-1020 nine-cylinder radial Diesel engine (which see).

Diesel Power, Inc. is making plans to produce the new flat-four engine as soon as it has received C.A.A. approval.

THE THAHELD DIESEL.

TYPE.—Four-cylinder horizontally-opposed air-cooled.
CYLINDERS.—Bore 4⅞ in. (124 m/m.), Stroke 3⅞ in. (98 m/m.), Capacity 290 cub. in. (4.75 litres), Compression ratio 16 : 1. Steel cylinder barrels and aluminium cylinder heads.
PISTONS.—Aluminium.
VALVE GEAR.—One inlet and one exhaust valve per cylinder operated by push-rods. Entire valve gear enclosed.
CONNECTING RODS.—I-section rods with bronze-backed babbitt-faced bearings.
CRANKCASE.—Aluminium alloy.
LUBRICATION.—Dry-sump type.
FUEL.—Min. 50 octane refined Diesel oil meeting AN specifications.
WEIGHT DRY.—235 lbs. (106.7 kg.).
PERFORMANCE.—Maximum output 100 h.p. or 125 h.p., Fuel consumption (cruising) .20 lbs. (0.9 kg.) per h.p./hr. approx.

WARNER.

THE WARNER AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: 20263, HOOVER AVENUE, DETROIT 5, MICH.

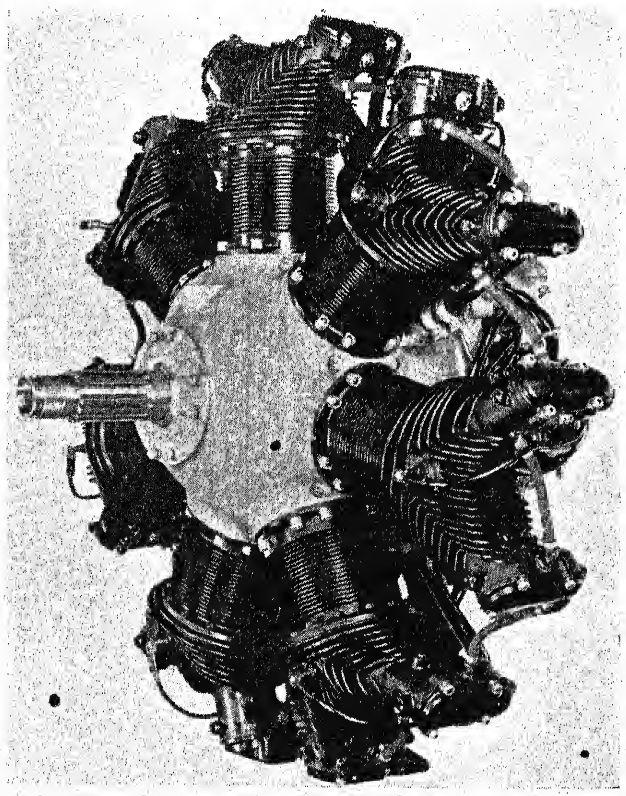
President and General Manager: W. O. Warner.
Vice-President and Sales Manager: L. A. Faunce.
Vice-President and Chief Engineer: L. A. Majneri.
Secretary and Treasurer: W. J. Jarvie.

The first Scarab was produced by Aeronautical Industries, Inc., in April, 1927. In October of the same year the company assumed its present name. The Warner Scarab-Junior was introduced in 1930, and during 1933, a larger engine, the 145 h.p. Super-Scarab, was designed and built.

The earlier 90 h.p. Scarab-Junior, 125 h.p. Scarab and 145 h.p. Super-Scarab engines have been illustrated and described in earlier Volumes. Descriptions of the Super-Scarab Model 165 and 185 engines are given below.

THE WARNER R-500 SUPER-SCARAB 165.

TYPE.—Seven-cylinder air-cooled radial.
CYLINDERS.—Bore 4.625 in. (118 m/m.), Stroke 4.25 in. (108 m/m.). Capacity 499 cub. in. (8.2 litres). Compression ratio 6.4 : 1. Alloy steel barrels machined all over and amply provided with cooling fins. Heat-treated aluminium-alloy heads shrunk and bolted to barrels. Intake valve-seats of aluminium-bronze, exhaust valve-seats of austenitic steel.
PISTONS.—Heat-treated aluminium-alloy castings, machined all over. Two compression rings and one scraper ring. Full-floating gudgeon pins.
CONNECTING RODS.—Heat-treated alloy-steel forgings of I-section. Master-rod is split type with replaceable lead-bronze steel-backed bearing shell at the crank-pin end. Link-rods are assembled to the master-rod by wrist-pins locked in the link-rods and operating in bronze bearings which are drilled to provide full forced-feed lubrication. Bronze bearings pressed into the small ends.
CRANKSHAFT.—One-piece alloy-steel drop forging, machined all over and heat-treated. Airscrew end machined to an S.A.E. No. 20 spline.
CRANKCASE.—Barrel type of heat-treated aluminium-alloy, cast in two halves and bolted together on the transverse centre-line. In the rear half is inserted a heat-treated machined steel bearing cage and this and two bronze bearing sleeves, which are shrunk and pinned in the front half of the crankcase, form definite locating



The 165 h.p. Warner Super-Scarab 165 engine.

WARNER—continued.

media for the main shaft ball-bearings, thereby preventing local bearing loads from being transmitted directly to the aluminium crankcase.

VALVE GEAR.—One inlet and one exhaust valve per cylinder. Inlet valve of cobalt chrome steel, exhaust valve of austenitic steel. Rocker-arms completely enclosed in housings cast integral with cylinder-heads. Cam ring is a machined alloy-steel drop forging and hardened on all wearing surfaces. It operates on a replaceable bronze bushing which floats on the heat-treated main bearing sleeve. All valve mechanism is lubricated automatically by a combination pressure-gravity system which originates in the rocker-arm bearings of No. 1 cylinder.

CARBURATION.—One Holley Model 419 carburettor attached to the lower part of the induction housing which is bolted directly to the rear of the crankcase. Separate intake pipes lead directly to each cylinder.

IGNITION.—Dual Scintilla Model VMN7-DF magnetos flange-mounted on rear cover. Two sparking-plugs per cylinder.

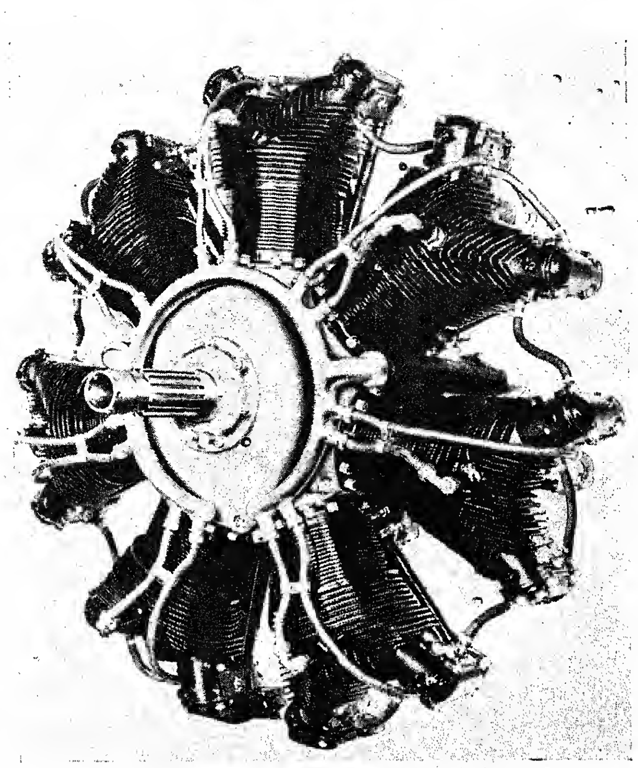
ACCESSORY DRIVES.—Mounting pads provided on rear cover for starter, generator, fuel pump and tachometer drive, and there are two additional drives. Two drives also provided for the magnetos.

LUBRICATION.—Combination pressure and gravity system. Rocker-arm bearings of No. 1 cylinder are lubricated by oil forced from the pressure system to the rocker-arm shafts. This oil is drained into the rocker-arm housings and, from the housings, is gravity fed to the remaining cylinders, accumulating in the covers of the exhaust rocker-arm housing of No. 5 cylinder and the intake rocker-arm housing cover of No. 4 cylinder. These two covers also act as a sump for the oil which is drained from the crankcase through the push-rod tubes. The scavenging pump picks up the oil at this point and returns it to the oil tank. Crankshaft and connecting rods drilled for forced feed. Pistons and cylinder walls lubricated by splash.

DIMENSIONS.—Overall diameter 37.25 in. (947 m/m.), Overall length (without starter) 30.5 in. (775 m/m.).

WEIGHT DRY (with unshielded ignition and without optional accessories).—341 lbs. (154.8 kg.).

PERFORMANCE.—Rated power at sea level 165 h.p. at 2,100 r.p.m. Take-off power 175 h.p. at 2,250 r.p.m., Fuel consumption at rated output .58 lb. (.263 kg.) per h.p. hour, Oil consumption at rated output .025 lb. (.0114 kg.) per h.p. hour.



The 200 h.p. Warner Super-Scarab 185 engine.

THE WARNER R-550 SUPER-SCARAB 185.

The R-550 Super-Scarab is, except for a slight increase in bore, identical to the R-500 model.

DIMENSIONS.—Bore 4.875 in. (124 m/m.), Stroke 4.25 in. (108 m/m.), Capacity 555 cub. in. (9.1 litres). Overall dimensions same as for 165 h.p. Model.

WEIGHT DRY (with unshielded ignition and without optional accessories).—344 lbs. (156.2 kg.).

PERFORMANCE.—Rated power at sea level 180 h.p. at 2,100 r.p.m., Take-off power 200 h.p. at 2,475 r.p.m., Consumptions as for 165 h.p. model.

WRIGHT.

THE WRIGHT AERONAUTICAL CORPORATION.
(A DIVISION OF THE CURTISS-WRIGHT CORPORATION.)

HEAD OFFICE: 30, ROCKEFELLER PLAZA, NEW YORK CITY, N.Y.

WORKS: WOOD-RIDGE, N.J.

President: Guy W. Vaughan.

Vice-President and General Manager: W. D. Kennedy.

Vice-President (Engineering): R. W. Young.

Secretary: J. M. Scanlan.

Treasurer: C. C. King.

The Wright Aeronautical Corporation, now approaching its 27th anniversary as a producer of aircraft engines, has consolidated all its facilities in the new Wood-Ridge, N.J., plant, a single large manufacturing building covering 35 acres under one roof—the largest aircraft engine plant in the United States.

In the new plant, Wright Aeronautical will produce radial air-cooled engines ranging from 800 to 2,500 horsepower and gas turbines whose details and performance are still restricted by the armed forces.

During the war years the Paterson, Wood-Ridge and Cincinnati plants produced more than 280,000,000 horsepower for such aircraft as the Grumman Avenger and Wildcat; North American Mitchell; Curtiss Helldiver and Seahawk; Boeing Flying Fortress, Superfortress and C-97 transport; Douglas Dauntless and A-20; Lockheed Hudson and Constellation; Consolidated B-32; and Martin Mariner and Mars.

The Wood-Ridge plant, specially designed for the purpose, turned out more than 10,000 Cyclone 18s of 2,200 h.p. each for the Boeing B-29 Superfortresses. The Paterson plants, "home" of the company since 1919, manufactured 9, 14 and 18-cylinder Cyclones during the war years for the United States and its Allies; and the giant Cincinnati plant, built specifically to turn out Cyclone 14s, produced more than 50,000 of these power-units and, towards the end of the war, undertook parallel production of the Cyclone 18.

Although the war years brought emphasis on production of great numbers of standardized models, engineering development continues uninterrupted and the Cyclone 9 was raised to 1,425 h.p. at .95 lbs./h.p. (0.43 kg./h.p.) the most powerful air-cooled internal-combustion engine per pound of weight yet produced anywhere.

Development of the Cyclone 18 at 2,500 h.p. was also announced late in 1945 with the introduction of the BD model, which incorporates a new type forged head which replaces the cast cylinder head used on the Superfortress engine.

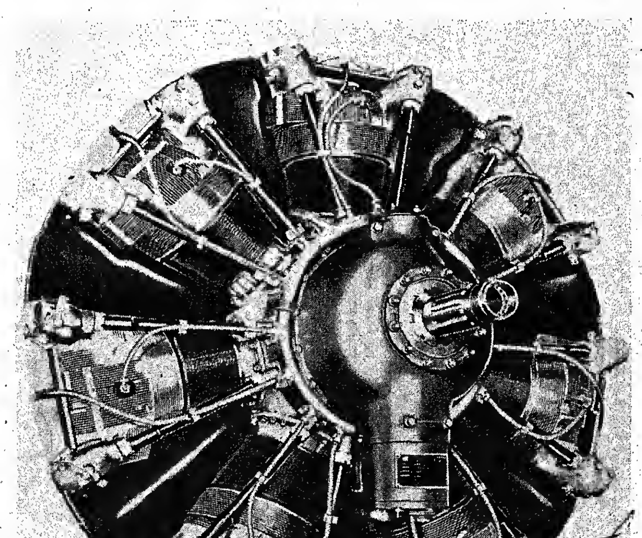
The Cyclone 7, "baby" of the Wright family since Whirlwind production was discontinued at the Wright plants, had been announced in 1945 at 700 h.p. and this was raised to 800 h.p. for take-off early in 1946.

Co-operating with the Rohr Aircraft Corporation, Wright engineers in 1945 developed a self-contained power egg for the Douglas DC-4 (Army C-54) to provide greater cruising speed, more economical maintenance and complete interchangeability.

Wright engines in production in 1946 are the Cyclone 7BA, the Cyclone 9HD, the Cyclone 14BB, the Cyclone 18BA and 18BD. A gas turbine is also in development but no information concerning the power-unit may be released for publication.

THE WRIGHT CYCLONE 7 SERIES.

Thr Cyclone 7 is a new seven-cylinder radial engine of 1,300 cubic inches (21.4 litres) displacement which incorporates many



The 800 h.p. Wright Cyclone C7BA engine.

WRIGHT—*continued.*

THE WRIGHT CYCLONE 7 SERIES.

Engine Model	Take-off Horsepower	Normal Rating (low blower)	Normal Rating (high blower)	Compression Ratio	Blower Ratio	Reduction Gear Ratio	Dry Weight	Fuel Grade
735C7BA1	800 h.p. at 2,600 r.p.m.	600 h.p. at 2,400 r.p.m. at 9,500 ft. (2,900 m.)	500 h.p. at 2,400 r.p.m. at 14,400 to 17,000 ft. (4,270 to 5,185 m.)	6.2 : 1	7.21 : 1 and 8.69 : 1	.661 : 1	929 lbs. (421.7 kg.)	91/96
744C7BA1	800 h.p. at 2,600 r.p.m.	600 h.p. at 2,400 r.p.m. at 9,500 ft. (2,900 m.)	—	6.2 : 1	7.21 : 1	.661	919 lbs. (417.2 kg.)	91/96

components of the Cyclone 9. It has been developed specifically for commercial purposes to meet the requirements of small transport and feeder-line aircraft.

The Cyclone 7 uses the type of forged cylinder-heads and W-type cooling-fins introduced in the C9HC series, but unlike other engines in the Cyclone series it operates on 91/96 grade fuel. Introduced originally at 700 h.p. for take-off, the C7 is now rated at 800 h.p.

Stationary oil jets in the crankcase direct a continuous stream of oil on pistons and cylinder walls for improved lubrication and piston cooling, the latter designed to eliminate detonation.

Type.—Seven-cylinder radial air-cooled.

Cylinders.—Bore 6.125 in. (155.6 m/m.), Stroke 6.312 in. (160.2 m/m.), Capacity 1,300 cub. in. (21.4 litres), Compression ratio 6.2 : 1. Nitrided forged-steel barrels with W-type aluminium cooling-fins inserted into grooves machined in barrel. Cylinder-head forged aluminium with machine-cut fins giving greater cooling and high tensile strength. Head screwed and shrunk to barrel.

Pistons.—High tensile aluminium-alloy forgings.

Connecting Rods.—One forged steel master-rod of the solid big-end type with steel-backed anti-friction bearing. Six H-section articulated rods.

Crankshaft.—Single-throw two-piece forged steel crankshaft dynamically dampened.

Crankcase.—Cylindrical forged steel two-piece power section with front and rear sections of magnesium-alloy. Front section houses reduction gearing and rear sections house supercharger, diffuser, accessory-drive gears and mountings.

Valve Gear.—Two valves per cylinder. Exhaust valve sodium-filled. Valves actuated by push-rods and roller-type cam-follower. Shelf-type cams improve service life by reducing deflection.

Carburation.—Stromberg PD9E carburettor.

Lubrication.—Dry sump pressure type. Stationary continuous-flow jets lubricate pistons and cylinder walls, improving piston cooling by elimination of detonation.

Accessories.—Bosch SF8LU-1 magnetos, carburettor, priming system accessory drives and covers, cooling air deflectors and baffles, are standard equipment. Torquemeter, inter-cylinder air ducts, and airscrew-speed cooling-fan optional.

Dimensions.—Overall diameter 52.15 in. (1,325 m/m.), Length 48.22 in. (1,225 m/m.).

Weights and Performance.—See Table.

THE WRIGHT CYCLONE 9 SERIES.

The most powerful air-cooled radial engine per pound of weight in the World, the new C9HD model is a late development of the series which began more than a decade ago with the introduction of the first Cyclone 9. The C9HD is produced in three models with single or two speed mechanical superchargers. A ratio of 7.21 : 1 is used in the single-speed model and for the low blower in the two-speed models, with a choice of 8.69 : 1 as high blower in one model and 10.14 : 1 in the other.

Basically, the C9HD is built on the same design principles as its predecessors, but the development of stronger materials, plus improved volumetric efficiency, has led to greater power from the 1830 cub. in. (3.98 litres) which has been standard displacement for the C9s for several years.

Cylinders.—Bore 6.125 in. (155.6 m/m.), Stroke 6.875 in. (174 m/m.). Capacity 1,823 cub. in. (29.88 litres). Forged aluminium-alloy heads, "course/fine" finning with a minimum of fins on the forward side and a maximum on the rear side for well balanced cooling. The exhaust-valve seats are of shrunk-in stellite alloy. The cylinder barrel is cooled by W-type inserted aluminium fins with the bottom fin of steel to prevent damage while installing or removing cylinder head hold-down capscrews.

Pistons.—Forged aluminium-alloy with three oil and two compression rings.

Connecting Rods.—H-section single-piece master-rod with steel-backed silver bearing. Eight forged steel articulated rods.

Crankshaft.—Two-piece single-throw forged steel dynamically-dampened shaft supported in roller bearings. Crank shaft strengthened to accommodate higher powers.

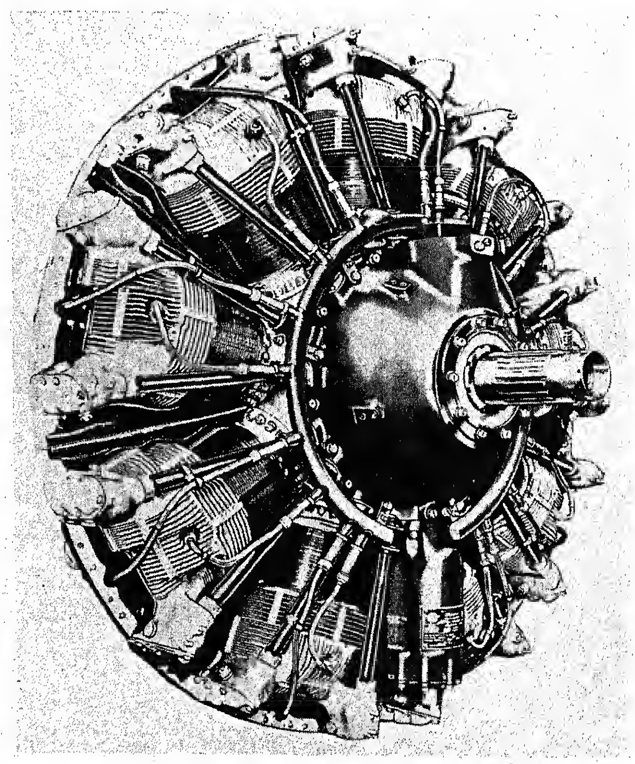
Crankcase.—Two-piece power section generally similar to others in the C9 Series except for some redesign to accommodate stationary oil-jets. Power section of forged steel-alloy and front and rear sections of cast magnesium alloy.

Carburation.—Stromberg PD12K10 carburettor mounted on top of supercharger housing at rear of engine. Supercharger and diffuser redesigned to provide manifold pressure required by higher powers and to improve fuel distribution at higher altitudes.

Lubrication.—Dry sump. Stationary oil jets in crankcase for continuous cylinder wall and piston lubrication and cooling.

Accessories.—Carburettor, two Scintilla SF9LN-4 magnetos, priming system, baffles and air deflectors, accessory drives and covers. Optional equipment includes airscrew-speed cooling-fan, inter-cylinder cooling ducts, manifold-pressure regulator, torquemeter.

Airscrew Drive.—.666 : 1 or 5625 : 1, Spline size SAE 50, Rotation clockwise when viewed from rear end.

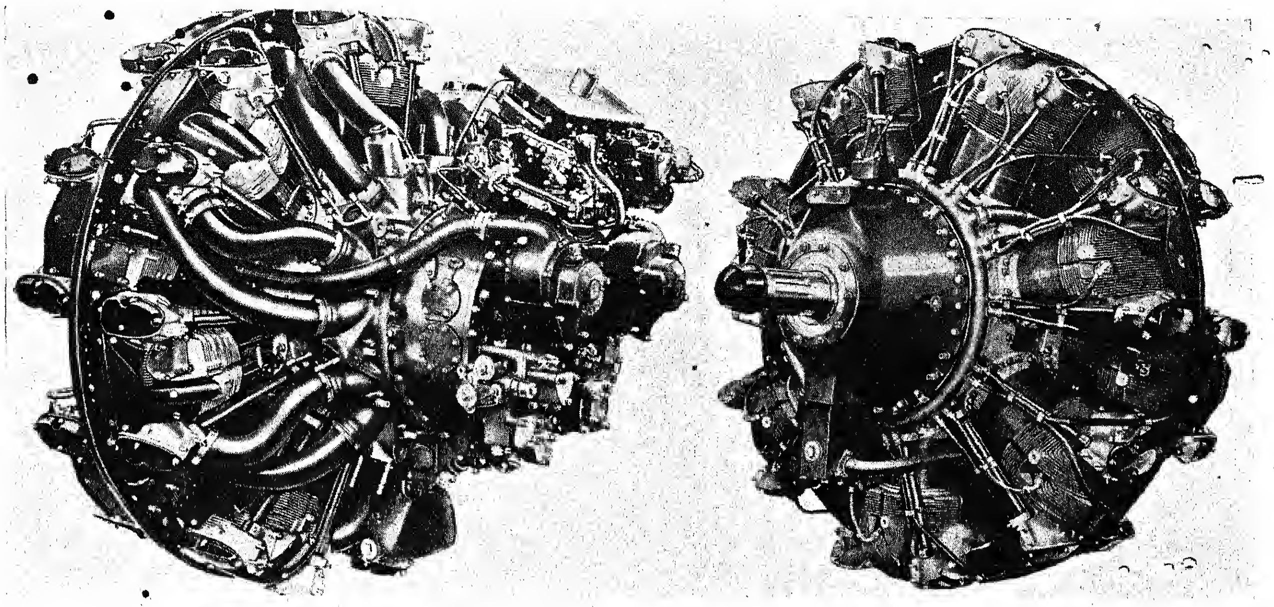


The 1,425 h.p. Wright Cyclone C9HD engine.

THE WRIGHT R-1830 CYCLONE 9 SERIES.

Engine Model	Take-off Horsepower	Normal Rating (low blower)	Normal Rating (high blower)	Compression Ratio	Blower Ratio	Reduction Gear Ratio	Dry Weight	Fuel Grade
736C9HD1	1,425 h.p. at 2,700 r.p.m.	1,275 h.p. at 2,500 r.p.m. at 3,500 ft. (1,070 m.)	1,125 h.p. at 2,500 r.p.m. at 10,000 ft. (3,050 m.)	6.80 : 1	7.21 : 1 and 8.69 : 1	.5625 : 1	1,376 lbs. (624.7 kg.)	100/130
737C9HD1	1,425 h.p. at 2,700 r.p.m.	1,275 h.p. at 2,500 r.p.m. at 3,500 ft. (1,070 m.)	975 h.p. at 2,500 r.p.m. at 18,300 ft. (5,580 m.)	6.80 : 1	7.21 : 1 and 10.14 : 1	.5625 : 1	1,371 lbs. (622.4 kg.)	100/130
740C9HD1	1,425 h.p. at 2,700 r.p.m.	1,275 h.p. at 2,500 r.p.m. at 3,500 ft. (1,070 m.)	—	6.80 : 1	7.21 : 1	.5625 : 1	1,365 lbs. (619.7 kg.)	100/130

WRIGHT—*continued.*



The 1,900 h,p. Wright Cyclone C14BB fourteen-cylinder two-row radial air-cooled engine.

DIMENSIONS.—Diameter 54.95 in. (1,395 m/m.), Length 49.09 in. (1,247 m/m.).
WEIGHTS AND PERFORMANCE.—See Table.

THE WRIGHT R-2600 CYCLONE 14 SERIES.

The Cyclone 14 of the first, or "A" series, equipped with an aluminium-alloy crankcase, has been discontinued entirely. A new model, known as the "BB" series, was, however, placed in production during 1944. While following the general lines of the earlier models, it is rated at 1,900 h.p. for take-off, and is equipped with cast aluminium cylinder heads and the new Wright W-type cylinder barrel fins.

CYLINDERS.—Bore 6.125 in. (155.6 m/m.), Stroke 6.312 in. (160.2 m/m.), Capacity 2,603 cub. in. (42.7 litres). Barrels of the A and BA series are machined from nitralloy steel forgings, have inner surfaces nitrided and are screwed and shrunk into aluminium-alloy heads. The cooling fins of the A and BA series are machined on the outside of the barrels while the BB series have W-type aluminium fins rolled into grooves cut on the outside of the barrels. All engines in this series have a hemispherical combustion chamber with two inclined valves operating in bronze guides shrunk into head. Sparking-plug bushings on opposite sides of head between valves. Valve rocker-arms and springs enclosed in housings cast integrally with the head. Complete system of pressure baffles to provide efficient cooling for barrels and heads of front and rear rows of cylinders.

PISTONS.—Wright "uniflow" type pistons with three compression rings and three oil control rings, the bottom ring being inverted. Case hardened piston pins have bevelled ends and are retained by coiled spring retainers bedding in annular grooves at ends of piston pin holes.

CONNECTING RODS.—Single-piece H-section master-rod and six articulated rods machined from solid forgings. Main crank-pin bearing of copper-lead alloy with steel backing in the A series, and of plated silver in the B series. A steel spider ring with a silver-plated face is fitted over one end of the bearing and provides oil passages outside the master-rod to lead excess oil from the main bearing to the knuckle pins, and also secures them in place. At other end of bearing is a silver-plated slip ring.

CRANKSHAFT.—Two-throw clamping type permitting use of single-piece master-rods. Each crankcheek carries movable dynamic-damper counterweights on hardened steel rollers. Forward section of shaft splined to accommodate the driving bell-gear, rear section splined inside the rear bearing journal to receive the accessory drive shaft.

THE WRIGHT R-2600 CYCLONE 14 SERIES

Engine Model	Take-off Power	Normal Rating (low blower)	Military Rating (low blower)	Normal Rating (high blower)	Military Rating (high blower)	Com-pression Ratio	Blower Ratio	Gear Ratio	Dry Weight	Fuel Grade
579C14AC1 (-A2A)	1,600 h.p. at 2,400 r.p.m.	1,350 h.p. at 2,300 r.p.m. at 6,200 ft. (1,890 m.)	1,600 h.p. at 2,400 r.p.m. at 1,500 ft. (460 m.)	—	—	6.85 : 1	7 : 1	.5625 : 1	1,935 lb. (878 kg.)	100
GR-2600-A2B	1,600 h.p. at 2,400 r.p.m.	1,350 h.p. at 2,300 r.p.m. at 5,800 ft. (1,770 m.)	1,600 h.p. at 2,400 r.p.m. at 1,500 ft. (460 m.)	—	—	6.30 : 1	7 : 1	.5625 : 1	1,935 lb. (878 kg.)	91
GR-2600-A5A	1,600 h.p. at 2,400 r.p.m.	1,350 h.p. at 2,300 r.p.m. at 5,000 ft. (1,525 m.)	1,600 h.p. at 2,400 r.p.m. at 1,500 ft. (458 m.)	1,275 h.p. at 2,300 r.p.m. at 12,000 ft. (3,660 m.)	1,400 h.p. at 2,400 r.p.m. at 11,500 ft. (3,510 m.)	6.85 : 1	7.14 : 1 and 10 : 1	.5625 : 1	1,950 lb. (885 kg.)	100
GR-2600-A5B	1,600 h.p. at 2,400 r.p.m.	1,350 h.p. at 2,300 r.p.m. at 5,000 ft. (1,525 m.)	1,600 h.p. at 2,400 r.p.m. at 1,000 ft. (305 m.)	1,275 h.p. at 2,300 r.p.m. at 11,500 ft. (3,510 m.)	1,400 h.p. at 2,400 r.p.m. at 10,000 ft. (3,050 m.)	6.30 : 1	7.14 : 1 and 10 : 1	.5625 : 1	1,950 lb. (885 kg.)	91
585C14BA1	1,700 h.p. at 2,500 r.p.m.	1,500 h.p. at 2,400 r.p.m. at 6,700 ft. (2,040 m.)	1,700 h.p. at 2,500 r.p.m. at 4,100 ft. (1,250 m.)	—	—	6.9 : 1	7.3 : 1	.4375 : 1	1,965 lb. (892 kg.)	100
586C14BA1	1,700 h.p. at 2,500 r.p.m.	1,500 h.p. at 2,400 r.p.m. at 6,700 ft. (2,040 m.)	1,700 h.p. at 2,500 r.p.m. at 4,100 ft. (1,250 m.)	1,350 h.p. at 2,400 r.p.m at 15,000 ft. (4,575 m.)	1,450 h.p. at 2,500 r.p.m. at 14,100 ft. (4,300 m.)	6.85 : 1	7.06 : 1 and 10.02 : 1	.5625 : 1	1,980 lb (900 kg.)	[illegible]
742C14BB1	1,900 h.p. at 2,800 r.p.m.	1,600 h.p. at 2,400 r.p.m. at 5,000 ft. (1,525 m.)	1,750 h.p. at 2,600 r.p.m. at 3,200 ft. (975 m.)	1,350 h.p. at 2,400 r.p.m. at 14,800 ft. (4,510 m.)	1,450 h.p. at 2,600 r.p.m. at 15,000 ft. (4,575 m.)	6.9 : 1	7.06 : 1 and 10.06 : 1	.4375 : 1 and .5625 : 1	2,090 lb. (949 kg.)	100/130

WRIGHT—*continued.*

Crankcase.—Main case for the A series consists of three aluminium-alloy forged sections divided through the centre-lines of both banks of cylinders. Through-bolts tie the centre-section to the two outer sections between each pair of cylinders in each bank. For the B series the crankcase sections are steel forgings attached to each other by means of small internal lugs. Front and rear sections accommodate valve-tappet mechanism. The combined sections contain the three main crankshaft roller-bearings. Magnesium-alloy reduction-gear section and supercharger housings bolted on fore and aft. Supercharger front housing serves as engine-mounting section.

Valve Gear.—Two valves per cylinder. Intake valves have concave heads and solid stems, exhaust valves hollow sodium-cooled stems, convex heads and stellite facings. Cam-rings driven off both ends of crankshaft through intermediate gearing at one-sixth engine speed. Totally-enclosed push-rods.

Carburation.—The single-speed blower engine has a Holley Model 1685F variable-venturi downdraft carburettor and the two-speed blower engine has a Stromberg Model PR 48A pressure-injection downdraft carburettor. Both are non-icing, fully automatic and compensate for varying densities of the air and special fuel requirements for acceleration. The mixture is fed through induction passage to supercharger impeller and to cylinders through radial intake pipes. The 11 in. (28 c/m.) diameter impeller rotates on plain bearings.

Lubrication.—Dry sump full-pressure type. One pressure and one or two scavenge pumps contained in same housing at rear of engine. Oil supply for main bearings and front sections of engine enters at rear of crankshaft. Master-rod bearings, knuckle-pins, cams, supercharger drive mechanisms, and accessory drives also lubricated by pressure. All parts of valve gear lubricated automatically. Oil pressure available for operation of hydraulic type constant-speed full-feathering airscrew.

Accessories.—Accessory section follows standard Cyclone practice. Magnesium-alloy rear cover plate carries two magnetos, oil pump, provision for fuel pump, large and small vacuum pumps, starter and generator. Gears driving all accessories are of the spur type, driven by a central spring-loaded gear on the tail-shaft. All gears are machined from steel forgings, have hardened teeth and operate in bushings in the rear cover so that the entire system may be removed with cover.

Dimensions.—Overall diameter 55 in. (1,397 m/m.). Length 62.06 in. (1,567 m/m.).

Weight and Performance.—See Table.

THE WRIGHT CYCLONE 18 SERIES.

The Cyclone 18, which powered the Boeing B-29s during the air war against Japan, is continuing its service into post-war aviation as the power-plant for the Lockheed Constellation which is now in use by major American, European, and South American airlines.

In addition to the Constellation, the Cyclone 18 powers the Martin Mars flying-boat, the Consolidated B-32 bomber, the Boeing C-97, and the Lockheed P2V patrol bomber.

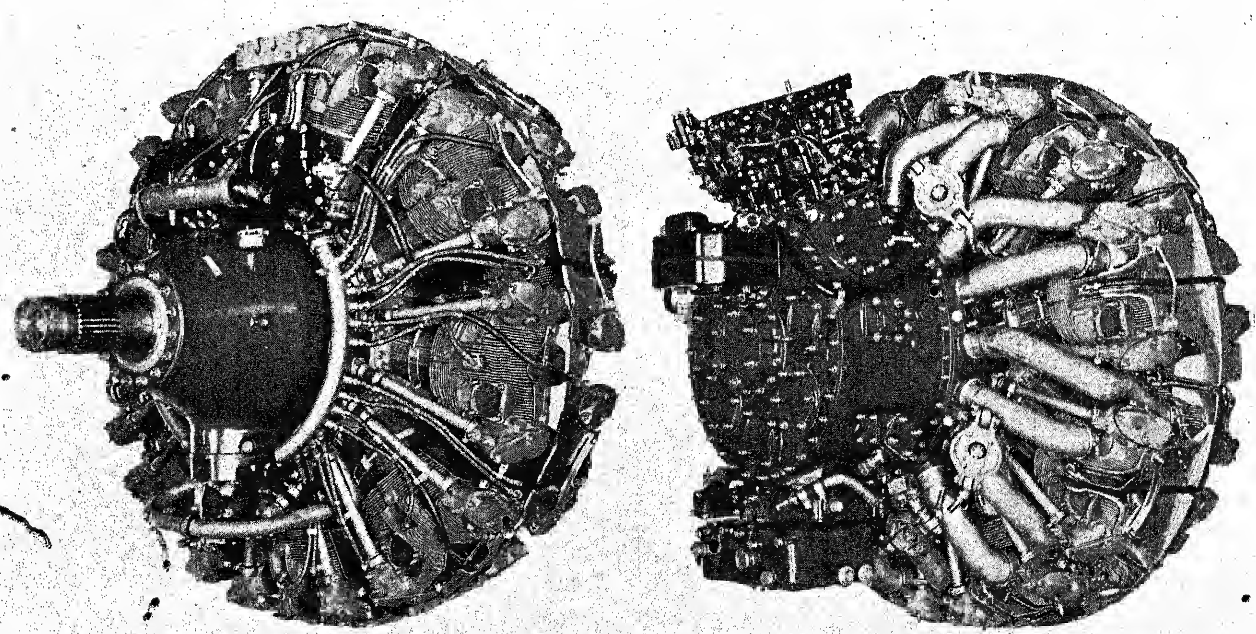
The BA model of the Cyclone 18 was the first to be put into large-scale production and developed 2,200 h.p. for take-off. The B-29 engine was equipped with a single-speed gear-driven supercharger housed within the engine and two General Electric turbo-superchargers housed beneath the engine in the wall of the nacelle. The first version of the R-3350 was equipped with conventional carburation but later models, produced in quantity toward the end of the war, were equipped with direct fuel-injection.

Known as the BD model, the latest Cyclone 18 is rated at 2,500 h.p. for take-off and is designed for either single or two-speed superchargers and direct fuel-injection or carburation.

Type.—Eighteen-cylinder double-row geared and supercharged radial air-cooled.

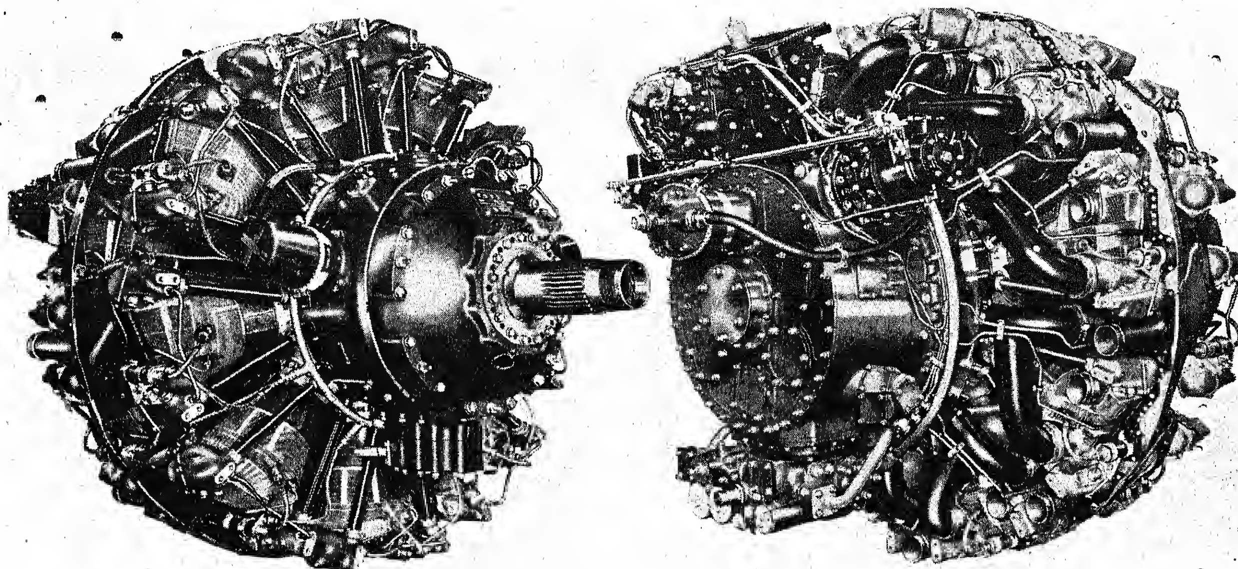
THE WRIGHT R-3350 CYCLONE 18 SERIES.

Engine Model	Take-off Horsepower	Normal Rating (low blower)	Normal Rating (high blower)	Compression Ratio	Blower Ratio	Reduction Gear Ratio	Dry Weight	Fuel Grade
739C18BA1 & 2	2,200 h.p. at 2,800 r.p.m.	2,000 h.p. at 2,400 r.p.m. at 5,500 ft. (1680 m.)	—	6.85 : 1	6.06 : 1	.4375 and .5625	2,646 lbs. (1,200 kg.)	100/130
745C18BA1	2,200 h.p. at 2,800 r.p.m.	2,000 h.p. at 2,400 r.p.m. at 2,500 ft. (730 m.)	1,800 h.p. at 2,400 r.p.m. at 14,000 ft. (4,260 m.)	68.5 : 1	6.61 : 1 and 8.81 : 1	.4375 and .5625	2,670 lbs. (1,212 kg.)	100/130
749C18BD1 (Fuel Injection)	2,500 h.p. at 2,800 r.p.m.	2,100 h.p. at 2,400 r.p.m. at 5,500 ft. (1,680 m).	1,800 h.p. at 2,400 r.p.m. at 16,000 ft. (4,880 m.)	6.5 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	2,884 lbs. (1,309 kg.)	100/130
951C18BD1	2,500 h.p. at 2,800 r.p.m.	2,100 h.p. at 2,400 r.p.m. at 5,500 ft. (1,680 m.)	—	6.5 : 1	6.46 : 1	.4375 : 1	2,764 lbs. (1,255 kg.)	100/130
952C18BD1	2,500 h.p. at 2,800 r.p.m.	2,100 h.p. at 2,400 r.p.m. at 5,500 ft. (1,680 m).	1,800 h.p. 2,400 r.p.m. at at 16,000 ft. (4,880 m.)	6.5 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	2,779 lbs. (1,264 kg.)	100/130



The 1,800-2,200 h.p. Wright Cyclone C18BA eighteen-cylinder two-row radial air-cooled engine.

WRIGHT—*continued.*



The 1,800-2,500 h.p. Wright Cyclone C18BD eighteen-cylinder two-row radial air-cooled engine.

Cylinders.—Bore 6.125 in. (155.6 m/m.), Stroke 6.312 in. (160.2 m/m.), Capacity 3,347 cub. in. (54.56 litres). Universal-type forged head with "course/fine" finning and increased finning in area of exhaust-valve for improved cooling. Forged head has greater total cooling area than cast type used on earlier C18s. Rocker boxes are slightly smaller than type previously used and are held in place by five studs.

Pistons.—Tapered interior to accommodate tapered articulated and master-rod ends. Five piston rings, three oil and two compression.

Connecting Rods.—Gudgeon-pin end of articulated rods tapered to accommodate maximum thrust on down stroke and lesser thrust on return stroke. Gudgeon-pin and knuckle pin bearings of bronze. Silver master-rod bearing is steel-backed and end-sealed. All rods shot-peened during manufacture.

Crankshaft.—Two-throw forged steel crankshaft dynamically-balanced with single-weight second-order balancers concentric with crankshaft.

Crankcase.—Eight-piece crankcase. Power section of forged steel front and rear sections of magnesium-alloy. Front or nose section in two pieces to facilitate maintenance. Reduction gear are "high overlap" type for increased tooth contact. Ball thrust-bearing mounted in front section and roller main bearings mounted in webs of crankcase power section. Electric torque pressure-indicator and provision for double-acting hydraulic airscrew provided in front section.

Valve Gear.—Valve seats Stellite-faced and shrunk into aluminium-alloy head. Rocker-arm ratio 1 : 1. Rocker-arms pivot on plain bearings. Push-rods enclosed in tubular housings with gland-type seals.

Fuel Metering.—BD Models manufactured with either direct fuel-injection or conventional carburation. Fuel-injection equipment includes two nine-cylinder pumps, master control, equalizer bar, fuel lines and cylinder injection nozzles. Supercharger impeller is new "inducer" type which improves both efficiency and capacity of impeller. "Siamese" Y-type intake pipes serve two cylinders each.

Lubrication.—Dry sump. Front sump pump scavenges to rear pump which supplies oil at pressure for lubrication. Front sump also has regulator for reduction-gear pressure. Crankcase has stationary oil jets built in.

Ignition.—Either high or low-tension. Low-tension type includes one generator mounted on rear cover, two 18-point distributor mounted on front section and distributing low-tension current to high-tension coil on each cylinder. This system cuts leakage and arcing and eliminates long travel of high-tension current. No supercharging of ignition system necessary for high-altitude flights

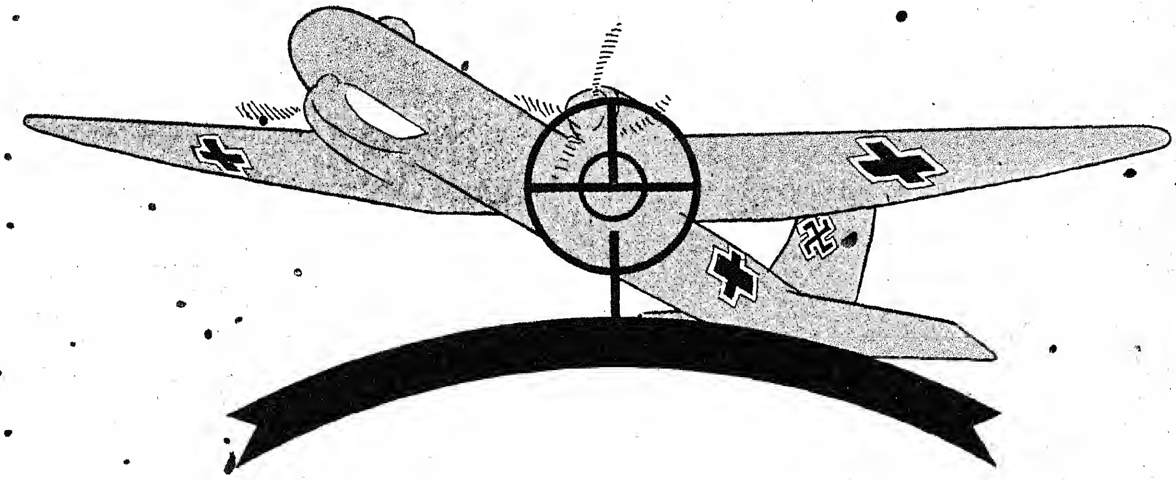
Accessories.—Rear cover strengthened for mounting of power take-off for cabin supercharging, etc. Double acting airscrew pitch control, torquemeter, priming system, fire-seal adapter flange, cooling-air deflectors, accessory drives and covers, Scintilla magnetos. Stromberg carburettor or Bendix fuel injection are standard equipment.

Optional Equipment.—Manifold pressure regulator, gear-driver cooling fan, airscrew-speed fan, .35 or .5625 reduction gears, anti detonant (water injection) equipment.

Dimensions.—Diameter 55.62 in. (1,413 m/m.), Length (Models 951 and 952) 78.14 in. (1,985 m/m.), Model 749 (fuel injection) 78.52 in. (1,994 m/m.).

Weights and Performance.—See Table.

Barr & Stroud Ltd



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GLASGOW, W W.1, ENGLAND